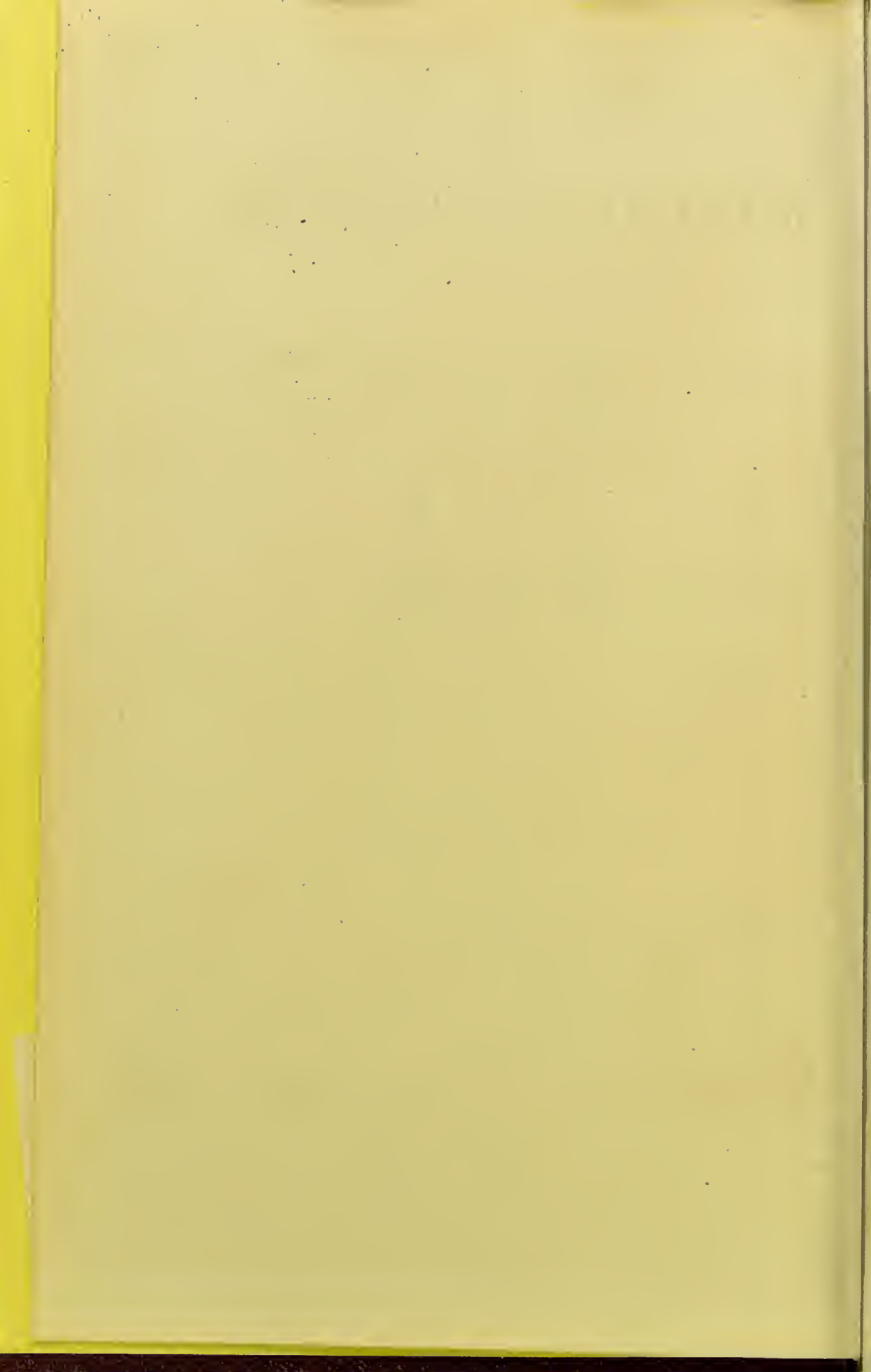


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A
MANUAL OF HYGIENE,
PUBLIC AND PRIVATE,
AND
COMPENDIUM OF SANITARY LAWS;

FOR THE INFORMATION AND GUIDANCE OF PUBLIC HEALTH
AUTHORITIES, OFFICERS OF HEALTH, AND
SANITARIANS GENERALLY.

BY
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L.K. & Q.C.P.I.,

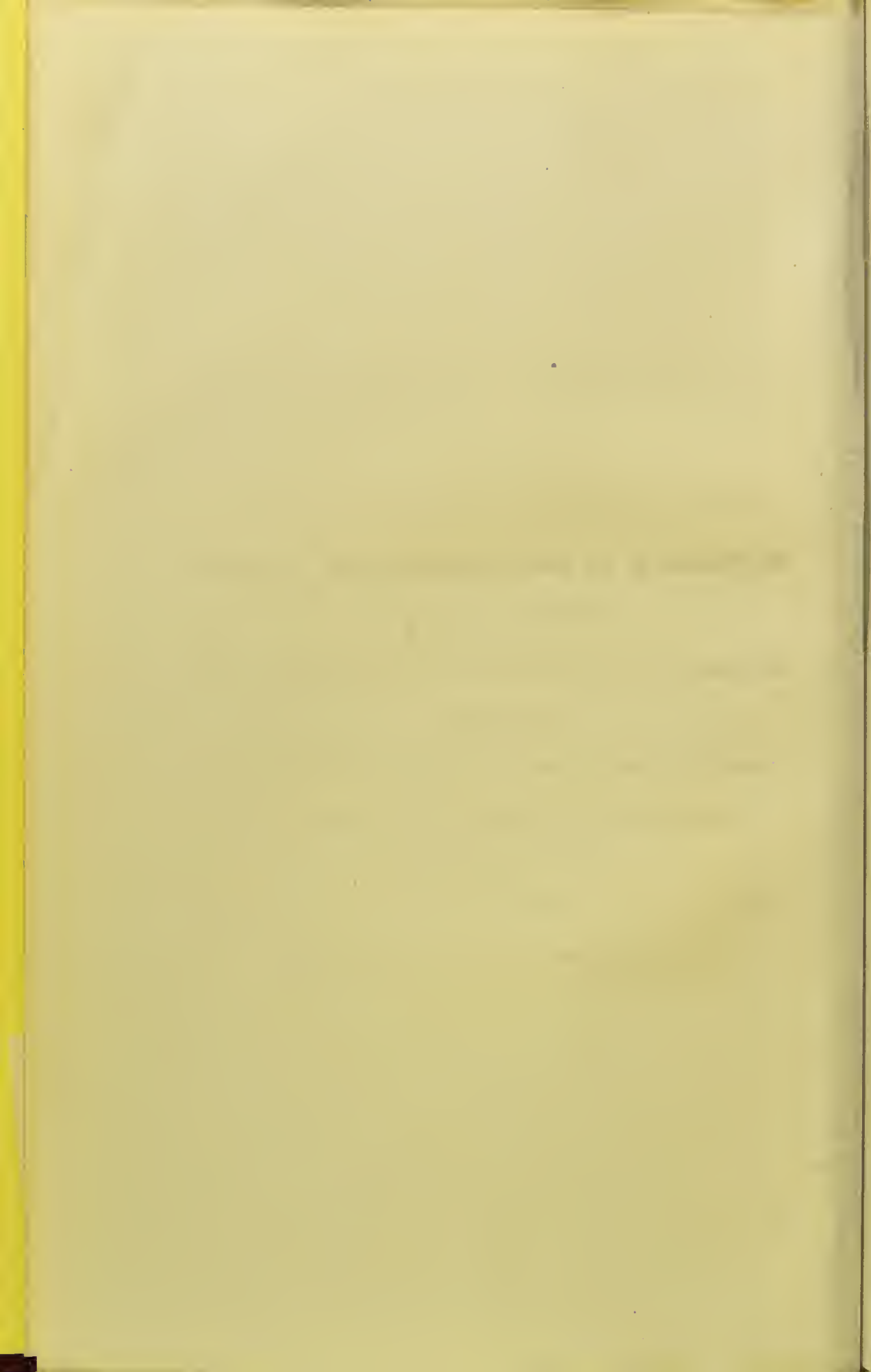
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Waterford, Kilkenny, Galway, and several Counties, &c., &c.*

SALUS POPULI SUPREMA EST LEX.

WITH THIRTY-FIVE ILLUSTRATIONS

DUBLIN:
HODGES, FOSTER, & CO., GRAFTON-STREET.

LONDON:
BAILLIÈRE, TINDALL, & COX.
1874.



TO

SIR ALFRED POWER, K.C.B.,

VICE-PRESIDENT OF THE LOCAL GOVERNMENT BOARD OF IRELAND,

I Dedicate this Work,

AS A TRIBUTE OF ADMIRATION TO THE STATESMANLIKE

QUALITIES,

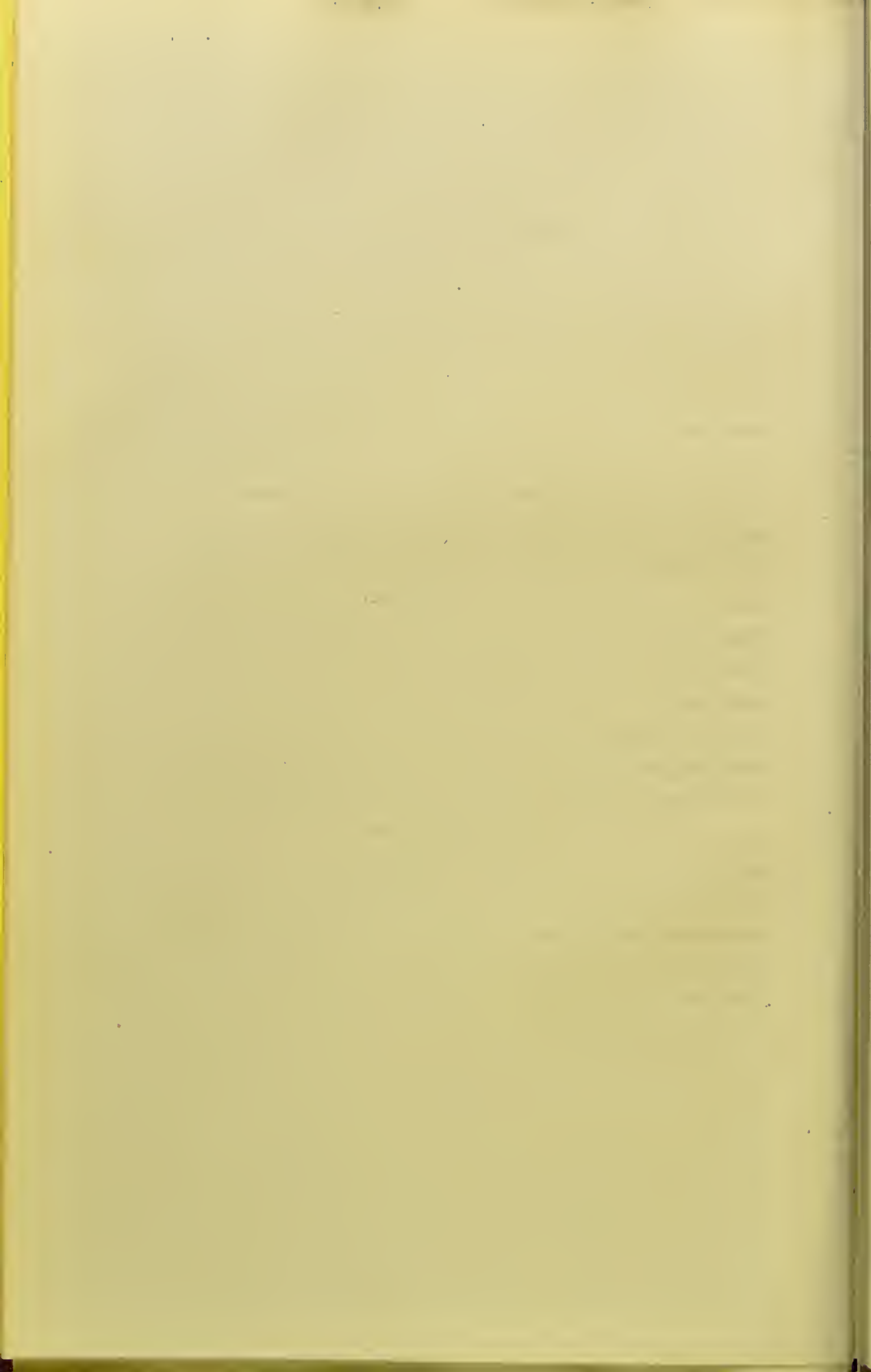
SOUND JUDGMENT, AND ENLIGHTENED LIBERALITY

EXHIBITED IN HIS SUPREME ADMINISTRATION

OF THE

LAWS FOR THE RELIEF OF THE POOR, AND THE

IMPROVEMENT OF THE PUBLIC HEALTH.



P R E F A C E .

THIS work is not offered to the reader as a complete treatise on sanitary science and political medicine ; but it contains information in relation to public hygiene sufficient for the requirements of the majority of health officers. I venture to hope that in its pages the non-professional reader will find all that he requires to know relative to such subjects as the heating and ventilation of dwellings, the disposal of house refuse, and diet, clothing, and exercise. The work includes 34 Statutes, or parts of them, relating to public health ; and these I trust will be found convenient for reference to all engaged in the administration of the sanitary laws. I have not given the Acts relating to factories, merchant ships, and vaccination. If I had done so the work would have been rendered unnecessarily bulky ; besides the persons concerned with these Acts are certain to be provided with copies of them.

This book having been written for the use of both professional and non-professional persons, portions of it will to the former, appear trite ; to the latter, too scientific. This was foreseen, but could not be avoided.

*Dublin, 15, Pembroke-road,
November, 1874.*



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CORRECTIONS.

- Page 17 Title of page, for "Dublin," read "Duties."
- „ 48 Line 15 from bottom, for "212," read "140."
- „ 100 First line, for "theain," read "the air."
- „ 104 For "Beall and Daucer," read "Beale and Dancer."
- „ 112 Title of page, insert before "ventilation," the word "bad."
- „ 128 Fourth line, read "Zeitschrift," for "Weitzschrift."
- „ 144 Title of page, read "poisons," for "persons."
- „ 253 Lines 21 and 27, read "1 acre," for "3 acres."

A MANUAL OF HYGIENE.

CHAPTER I.

INTRODUCTORY.

The Public Health (Ireland) Act of 1874 has created a permanent army of sanitarians for Ireland. In virtue of this Statute every dispensary doctor has become a medical officer of health, and in every Poor Law Union and in every town of more than 6,000 inhabitants it renders compulsory the appointment of at least one inspector of nuisances. This Act constitutes the Local Government Board of Ireland the highest public health authority in the country, and entrusts to it important directive and controlling powers, in relation to the local sanitary authorities. As the Act increases the work of the Poor Law medical officers, so also it increases their salaries. It was the intention of the framers of the Act that the amount of the increase should be determined by the Local Government Board; but the clause to that effect was amended so as to allow the local authorities to settle this important point. It is to be hoped that they will deal liberally with their medical officers, and it is well that they should bear in mind that their decisions on this point are subject to the approval of the Local Government Board. As in England one half of the salaries of the medical officers of health is paid out of the imperial exchequer, there is little doubt but that a moiety of the Irish health officers' stipend will be paid out of the same fund, agreeably to section 10 of the Public Health Act, 1874. When, therefore, a Board of Guardians votes an increase of £30 a year to their medical officer, as remuneration for his work as health officer, it really only gives him £15 a year out of the union fund.

The Public Health Act, Ireland, 1874, is chiefly intended to organize an administration for the purpose of carrying into effect the sanitary laws previously enacted. No doubt it will, in due time, be followed by other acts, framed for the purpose of dealing with sanitary evils which existing Statutes are unfitted to suppress. Perhaps, too, we may have before long the existing sanitary enactments codified, amended, and reconciled with each other; for at present many of them conflict. They are very numerous, too, if we include with the purely Sanitary Acts those relating to the protection of life and health, such as the Storage of Petroleum Act, the numerous Acts in reference to seamen, mines, and factories, and the Building Acts.

The sanitary condition of the majority of Irish towns is far from satisfactory. Most of them are badly drained, and are deficient in good supplies of water. Their death rates are often above the normal standard. This unsatisfactory state of things is to some extent due to want of wealth. Rich towns are more likely to be properly sewered and abundantly supplied with pure water than

poor ones. Making due allowance for the comparative poverty of Ireland, her people have, on the whole, shown a strong predilection for the enactment and enforcement of sanitary measures. The laws relating to vaccination have been cheerfully obeyed by all classes in this country. The Adulteration Act of 1860 was not put into force in any part of the United Kingdom, save Ireland. The first comprehensive Public Health Act passed by the British Parliament (that of 59 Geo. III., cap. 41) was applicable only to Ireland. In the Statutes of the Parliaments of Ireland we find numerous acts relating to public health. 2 Geo. III., cap. 6 (Parliament of Ireland), prohibited the making of bricks within two miles of the public lamps of Dublin, under a penalty of ten shillings per 1,000 bricks made. 11 and 12 Geo. III., cap. 28, prohibited the erection of lime kilns within the city of Dublin, on the ground that they were a nuisance and injurious to health. There are now several lime kilns situated in the most central and densely inhabited parts of this city! Other noxious manufactures were dealt with by the Irish Parliament. In 1717 a kind of Public Health Act for Dublin was passed, which enacted amongst other useful measures that any driver of a cart or waggon who sat on the vehicle instead of walking at the horse's head was liable, on conviction, to be fined, imprisoned, or publicly whipped, at the discretion of the justices. If this Act (which probably has never been repealed) were now enforced in Dublin the mortality from street accidents would be sensibly lessened. With respect to articles of food, drink, and medicine, several enactments are to be found in the Statute Books of the Irish Parliaments. Early in the reign of George III. an Act was passed to guard against the sophistication of drugs. In 1719 an Act was passed to prevent the pollution of the River Dodder, which at that time was one of the chief supplies of water for the city of Dublin. In 1665 the mixing of inferior with superior wines, and the adulteration of wines and other alcoholic liquors, were created statutable offences by the Act 18 Charles II., cap. 19. A long list of the articles, the addition of which to wines, &c., was illegal is given in this Act, and in substance resembles the adulteration clause of the Licensing Act of 1872. The penalties created by this Act were increased from £20 to £50 by a subsequent Act, passed in 1759.

Political medicine, strictly speaking, concerns itself but little relative to the cure of disease: the problem which it seeks to solve is, how disease may be averted. The results of the investigations of the pathologist and the physiologist establish more or less accurately the nature of a malady, and suggest the appropriate treatment. The cultivator of political medicine, applying the knowledge acquired by the labours of the physiologist and the pathologist to his own purpose, endeavours to remove the cause or causes which produced the disease. Those who devote themselves to the study of public hygiene require, therefore, a more extended knowledge of science than a mere physician or surgeon, who occu-

pies himself solely with the curative treatment of disease. Sanitary science is made up of many branches of knowledge, and the great questions relating to the public health can only be successfully answered by those who combine in themselves the knowledge—more or less profound—of the physician, the chemist, the physicist, the botanist, and the geologist. It is to be regretted that the Public Health Act of 1874 does not provide appointments for such a class of men: and let us hope to see ere long every county in Ireland made a separate health district, and placed under the sole direction of a medical sanitarian. There is much wanted a class of highly-educated medical men who would wholly devote themselves to sanitary science. Physicians who are so fortunate as to have numerous patients cannot, as a general rule, spare time for purely scientific pursuits not directly affecting their practice; and it requires no argument to prove that very few active practitioners could successfully study such subjects as, for example, the water supply and sewerage of towns, the heating and ventilation of dwellings, epizootics dangerous to man, and epiphytic outbreaks—all of which relate to the public health.

There is a wide field for the labours of the professors of preventive medicine. A large proportion of the deaths which daily occur in these countries are due to diseases which hygienic means, vigorously employed, are capable of extirpating. Small-pox, some years ago, annually carried off several thousands of persons in Ireland alone; but, owing to the rigorous enforcement of that infallible preventive—vaccination—this loathsome disease has almost been “stamped out” in this island, though still permitted to ravage the sister countries. There is sufficient evidence to justify the belief that fever, cholera, whooping-cough, and, in a word, all infectious and contagious diseases, are produced by the introduction of an animal poison into the body—each variety of poison producing a different disease. These poisons are as much entities as are arsenic or strychnine; and as they possess in all probability an organized structure, they are capable of reproducing themselves under favourable conditions—that is, when located in the human body. On the other hand, it is nearly certain that these poisons cannot long exist in air, water, or earth. If these statements rest upon a foundation of truth, as I believe they do, then how important are not the problems of preventive medicine! The nature of the virus of each contagious disease has to be exhaustively investigated, and the conditions under which it is developed have to be discovered. These points ascertained, it would be easier to suggest efficacious measures for the prevention of the disease; and these measures might then come within the domain of State, or political medicine, and have to be enforced by sanitary enactments.

The effective administration of sanitary laws and the discovery of the facts upon which they are based involve a liberal pecuniary expenditure. Until very recently the money required to carry on

investigations relative to the public health was doled out in miserably small sums by the State. At present more enlarged and liberal ideas relative to sanitary matters prevail amongst the governing classes; and the Public Health Acts of 1872 and 1874 are a kind of recognition that the health of the British people is a matter worthy of the attention of our rulers.

The largest portion of the revenue of the country is devoted to the maintenance of our army and navy, designed to preserve to us our lives and liberty. This is a wise precaution; but are there not other enemies than our fellow-men, whose power we should always be prepared to resist? During the greatest wars waged by Great Britain, the deaths of her soldiers and sailors in actual combat were never a tithe of the number of her civil population slain by preventible diseases. In Dublin alone, small-pox, in a single year, has often killed more people than the British army lost at the battle of the Alma; and zymotic diseases annually carry off in London more lives than were lost by our army at the battle of Waterloo. I think I have said sufficient to convince even the most sceptical that the people of these islands require an army of sanitarians to protect them from the ravages of diseases which naturally have no abiding place amongst them. He who vanquishes those deadly enemies of man achieves a victory far more glorious than ever warrior won. Triumphs over those foes are not followed by the wail of the widow or the cry of the fatherless. The sole fruits of the conquest are long life, health, and happiness; and surely these are trophies worthy of a nation's ambition. I trust that at no remote period a fair proportion of the public funds will be devoted to the paramount object of promoting every measure tending to improve the health and increase the longevity of the community.

Hygiene is the science which relates to the physical condition of man, and to the means by which his health may be sustained, and his life prolonged to old age. Many of the laws of this science were known to the ancients. Asclepiades was aware of the advantages resulting from the use of wholesome food, good water, and pure air, and insisted that dietetic means were the most important in promoting health. Herodicus, five centuries before the Christian era, employed gymnastic exercise in the treatment of disease, and as a means of preserving the health. Many of Hippocrates' medical aphorisms refer to the means by which the body may be invigorated, and life prolonged. Pythagoras wrote much on sanitary subjects, and often with great acumen. Amongst the Greeks, the first code of State sanitary laws was that propounded by Lycurgus, which, severe, and even cruel, as it undoubtedly was, powerfully contributed to produce a race of vigorous, healthy, well-formed men. The sanitary observances of the Athenians, less severe than those practised by their sterner Spartan neighbours, yet served to preserve the physical condition of their bodies, without retarding the development of their intellectual faculties.

That the laws of public health observed by the classic Greeks were admirably adapted to promote the beauty of the human form, the exquisite marbles of Phidias and Praxiteles, of Scopas and Agasias, testify even at the present day.

The Romans contributed but little to the science of medicine; but they must at least have had a good practical acquaintance with military hygiene, for, even in modern times, the sanitary condition of armies in the field was inferior to that of the Roman legions during campaigns.

The Jews¹ have long enjoyed the inestimable advantages of a code of sanitary laws derived from a divine source, and implicitly observed for a period of 3400 years by the great majority of that people. They have always suffered less than Christians during epidemics; and the comparative immunity of this "peculiar people" from contagious and infectious diseases is evidently due to their habits of personal cleanliness, so imperatively enjoined by their religion.

During the middle ages very little attention was given to the subject of public health. The houses of the middle and lower classes were small, and the rooms incommodious and dark, and ill ventilated. The towns and cities were mostly enclosed within high walls; there were no sewers; the streets were unpaved and unlighted; the water supplies were often impure; and the dead were interred within the town. No hospitals existed for the relief of the sick, and every house in which a patient suffering from an infectious malady lay became a focus from which the disease spread. These were, as a general rule, the conditions under which the denizens of European towns existed during that long and dreary period which so truly has been termed the dark ages.

The disregard paid to the most obvious rules of health by the inhabitants of medieval cities produced a frightful mortality, which occasionally culminated to a point which threatened the extinction of populous communities. The average duration of human life did not exceed 20 years, and in some very unhealthy towns it was not more than 18 years. Dr. Farr states² that the mortality of children has been diminished to one-half during the last half century. In London the proportion of deaths of children under 5 years were—

From 1730 to 1749	...	...	...	74.5 per cent.
" 1770 „ 1789	...	...	..	51.5 „
" 1851 „ 1870	..	...	...	29.8 „

At a late period, when great strides in civilization had taken place, London was, with respect to sanitary matters, very much in

¹ De la Vitalité de la Race Juive en Europe; par M. Levy. *Annales-d'Hygiène Publicque*, t. xxv., 2nd series, 1866. A paper full of most interesting information relative to the biostatic peculiarities of the Jews.

² MacCulloch's *Statistical Account of the British Empire*, vol. ii., page 543.

the same condition, or, perhaps, worse than in the darkest period of the middle ages. Between the years 1629 and 1635 five persons in every hundred died annually in London. From 1660 to 1679—a period in which the frightful “plague” ravaged the city—the annual death rate was 8 per cent. From 1728 to 1780 the average number of deaths per hundred living was five, showing the mean duration of human life to have been only 20 years. At the present time London is the healthiest of the large cities of the United Kingdom, its death rate being less than 23 per 1,000 living.

I have stated that during the middle ages—indeed, I might have said until the eighteenth century—disease occasionally threatened to extirpate whole communities. In the fourteenth century a dreadful epidemic swept over Europe, destroying millions of persons, and creating universal consternation. It was known by the terrific term, *black death*, and few affected by it recovered. It was a highly inflammatory malady, the more prominent symptoms being eruptions of painful boils, expectoration of blood, inflammation of the lungs, bleeding at the nose, and black or blue patches on portions of the body, more especially the tongue and fauces. Sometimes the patient fell into a profound sleep, from which there was no awakening in this world; at other times there was continued sleeplessness during the whole course of the disease. This malady appears to have been beyond the reach of medical skill. It spread to the lower animals, of which immense numbers perished, more especially in the south of Europe. There is evidence to show that the black death originated in Asia—most probably in China—and gradually spreading westward, entered Europe, where, owing to the insanitary condition of the towns, the virus of the disease found a congenial, fructifying soil. It has been contended that the black death probably originated sporadically in Europe, owing to the filthy habits of the people; but I think it is most likely that the germ of the disease came in the first instance from the East—that fountain head of pestilential streams.

The history of nations is but little more than the biographies of monarchs. The annals of our country are ample on all subjects of a political character; but the inner life of the people, their habits and customs, their social condition and peculiarities, are topics which the historian touches lightly upon, or leaves unnoticed. The frightful pestilences which desolated the west of Europe in the fourteenth century are either not mentioned in the popular histories of France and England, or if alluded to, the space devoted to the description of those events, of such momentous interest to man, is less than that occupied in describing the personal appearance of a king or the details of a petty battle. Imagination fails to realise the extent of misery caused by the epidemics of the fourteenth century. In the great outbreak to which I have just alluded, it has been estimated that nearly 40,000,000 people perished in the east alone. In Germany, where the disease was least virulent,

more than 1,200,000 fell victims to it. In Italy the mortality was frightful—Venice lost 100,000 of her citizens, Sienna, 70,000, and Florence, 50,000. In London the disease raged with great violence, 50,000 persons having been interred in one burial place. Throughout the whole country it is certain that more persons fell victims to the disease than were spared by it; for, according to one statement, but evidently an exaggerated one, not a tenth of the inhabitants were left alive. It has been stated that the black death carried off, at the most moderate computation, a fourth part of the inhabitants of Europe, or about 25,000,000 of souls.

I have alluded to the dreadful epidemics of the middle ages in order to show the great saving of life which has resulted from the improvement of the sanitary conditions of towns, and also from the more general habits of personal cleanliness which distinguish the modern Europeans from their medieval ancestors. I also wish to direct attention to those almost forgotten calamities, because they are calculated to teach us important lessons. Are we sure that we are safe from another visitation of the black death? There are epidemiologists who believe that the germs of this disease still linger amongst the deep valleys of the Himalayas, and that they may yet be wafted to Europe. If such an event should ever unfortunately take place, I fear that in some of our towns the virus of the disease would find a genial soil; but the general sanitary state of Europe renders unlikely the recurrence of the painful scenes of the fourteenth century. We know the means by which all such diseases may be successfully resisted, and it is to a great extent our own fault that even the Asiatic cholera is still allowed to force its way periodically into these countries. It was early discovered that these epidemic diseases were contagious, or, to use a popular expression, catching; and shortly after the first great outbreak of the black death, precautions were adopted in Italy for the purpose of isolating persons suffering from contagious disease. The earliest regulations for this purpose were issued on the 17th January, 1374, by the ruler of Reggio, the Viscount Bernabo, and they appear to have successfully accomplished his object. Bernabo's regulations, and those of his successor, were based on principles, the soundness of which is surprising, when we consider the darkness of the age in which they were framed. The patients were removed to the open field, and those in attendance upon them were not allowed to come in contact with healthy persons. Every consumable substance which had been in contact with the sick was committed to the flames. The houses of the affected were disinfected; and persons coming from places in which the disease existed were rigorously refused admission. Bernabo's regulations were, with various modifications, followed by the various States of Italy. In 1485 the first lazarettos, or quarantine houses, were established; and about 40 years later "bills of health" were issued to ship masters, stating whether or not the port from which they sailed was the seat of disease.

Since the sixteenth century the progress of sanitary legislation has been slow ; but within the last few years increased attention has been given to the important subject of public health, and the prospects of great improvements being effected in it are brighter than they have ever been. The causes of epidemiological diseases are now being thoroughly investigated. Local authorities are improving the hygienic condition of towns. The people are gradually being supplied with pure water ; and the legislature has taken active measures to prevent the pollution of our rivers and atmosphere. Every part of the United Kingdom is now provided with health officers.

CHAPTER II.

DUTIES OF SANITARY AUTHORITIES AND OFFICERS OF HEALTH.

SANITARY AUTHORITIES.

Under the provisions of the Public Health (Ireland) Act, 1874, this country is divided into sanitary districts of two kinds termed respectively urban and rural. The former comprise Dublin and the other incorporated towns, the towns and townships with local acts, and all towns of more than 6,000 inhabitants, having municipal governing bodies under the act of Geo. IV., relating to the lighting, cleansing, and washing of towns, under 3 & 4 Vict., cap. 108, and under 17 & 18 Vict., cap. 103. The rural districts comprise the poor law unions, except such parts of them as are included with urban districts. There are 38 urban, and 163 rural, districts. The present governing bodies of these districts—corporations and commissioners—are the sanitary authorities therein. They are entrusted with the execution of the Sanitary Acts, and have transferred to them all the sanitary powers formerly exercised by the “sewer” and “nuisance” authorities. During periods of epidemics the powers wielded by the municipal authorities relative to disinfection, burial of the dead, the conveyance of the sick, the providing of hospital accommodation, &c., are transferred temporarily to the Boards of Guardians of the urban districts. The sanitary authorities in the towns are for the first time brought under the supervision of the Local Government Board ; whilst the same authority continues to exercise that control over the actions of the Boards of Guardians which it always did under the provisions of the Poor Law Acts.

In districts where the Baths and Wash-houses Acts and the Labouring Classes Lodging-houses Acts are not in force, the local Sanitary Authority may adopt and apply them. The Local Government Board may also, on the application of the Sanitary Authority, repeal, alter, or amend any local sanitary acts, diminish the area of the district in which they are in force, or extend their operations to other districts. These are considerable powers indeed.

The Local Government Board may separate districts or towns of not less than 6,000 inhabitants from rural districts, and either erect them into urban districts or add them to urban districts already in existence. It may also add any town or other urban district to the rural district adjoining or enclosing it. All this can only be done on petition from the districts affected, and the order of the Board must be confirmed by Parliament before it becomes effective.

It is to be hoped that as many small towns as possible may be united with rural districts, as the former sanitary authorities are less likely to put the laws relating to health into force than the Boards of Guardians. Where part of a union is included within an urban district, the representatives from it are not entitled to vote on sanitary questions relating to the rural districts. This is fair enough; but in some cases it will seriously diminish the number of the members of the Boards of Guardians competent to deal with sanitary measures. Out of the thirty-two elected guardians of the South Dublin Union, ten only are representatives of rural districts. For statistical and other reasons it were desirable that the city of Dublin should form a single union, and that the rural divisions of the present South and North Dublin Unions should be erected into separate unions, or joined to rural ones—such as Rathdown. The North Dublin Union Workhouse would answer for a country union, and the South Dublin Workhouse for the city one. A large number of the deaths in these workhouses, which serve to swell the city death rate, should be added to the deaths in the county.

Under the Public Health Act every medical officer of a dispensary becomes, *ex officio*, a medical officer of health. The local authorities are also to appoint, when so required by the Local Government Board, a medical superintendent officer of health, and such other officers as may be necessary for the purpose of carrying the sanitary laws into effect. A portion of the salaries paid to these officials is to be recouped to the local sanitary authorities by Parliament. In England one half of the salaries of the sanitary officers has, up to the present, been paid out of the national exchequer. Presumably, a like proportion of the Irish health officers' salaries will be provided for by Parliament. The act enables sanitary districts, with the approval of the Local Government Board, to combine and virtually form one district for the purpose of obtaining a supply of water, or for sewerage the united district, or "for any other purpose of the Sanitary Acts or

Burial Ground Acts." In virtue of this power several sanitary districts might unite, and conjointly appoint a superintendent medical officer of health. It is to be hoped that a union of sanitary districts for such a purpose will become general throughout the country; for the emoluments which a single sanitary district could offer would not be likely (except in the case of a few large towns) to secure the services of a well-educated medical man, prepared to devote his whole time to sanitary matters. It is regrettable that the Local Government Board has not the power to direct the union of sanitary districts for certain purposes—the appointment of superintendent officers of health (or consulting medical officers of health, as the Local Government Board terms such officers), for example.

The chief duties of the sanitary authorities (unfortunately, mostly permissive only) are, to procure supplies of pure water; to prevent the pollution of air and water by foul liquids, gases, vapours, and dirt of all kinds; to prevent overcrowding of dwellings; to see that the houses of the labouring classes are in perfect tenable order; to prevent the keeping of the lower animals under such conditions as make them a nuisance injurious to health; to check the sale of adulterated, and of diseased and otherwise unsound food; to make sewers; to cleanse the streets and roads; to provide recreation grounds for the people; to erect baths and wash-houses; to take steps for the prevention of the spread of contagious diseases; to bury the very poor, and to provide and maintain burial grounds for rich and poor; to disinfect clothing and bedding; to construct dwellings for artisans. These important duties have hitherto been only performed fully by civic authorities: henceforth they are to be as efficiently (more so, let us hope) discharged by the Boards of Guardians.

The Local Government Board has addressed the following circulars to the different sanitary authorities:—

SANITARY ORDER.

No. 1. Relating to Rural Sanitary Districts consisting of entire Unions.

To the Guardians of each of the Unions named in the Schedule A to this Order annexed; to the Medical Officers of the Workhouse and of the Dispensary Districts therein; to the Clerk and other paid Officers thereof; and to all whom it may concern,

Whereas, by the "Public Health (Ireland) Act, 1874," each of the said unions has been constituted a rural sanitary district, and the guardians of the union are, as such, declared to be the rural sanitary authority:

And whereas, by the tenth section of the said act it is enacted that every medical officer of a dispensary district shall be a sanitary officer for such district, or for such part thereof as he shall personally be in charge of, and that every sanitary authority shall appoint in addition such other sanitary officers as the Local Government Board shall in each case direct:

Now we, the Local Government Board for Ireland, do, in the case of each union in the said schedule named, direct the guardians to appoint so many sanitary sub-officers as the guardians shall with our consent determine; and we do hereby direct and declare that the relieving officers of the union and the collectors of poor-rates shall be alike eligible for the office of sanitary sub-officer:

Local Government Board's Sanitary Orders. 11

And we do hereby further direct that the guardians of the union shall appoint one consulting sanitary officer, and that for this office every medical officer of the union, including the workhouse medical officer or officers, shall be eligible, and also, subject to our approval, any other medical practitioner having the same qualifications; and shall also appoint an executive sanitary officer, for which office the clerk of the union, or any assistant of the clerk appointed by the guardians, shall be eligible.

And whereas, by the said tenth section it is further provided that the Local Government Board shall assign to the dispensary medical officers, and to the other sanitary officers, their respective duties and functions in the discovery, or inspection, or removal of nuisances, in the supply of pure water, in the making or repairing of sewers and drains, or in generally superintending the execution of the sanitary laws within the district:

Now therefore, we, the Local Government Board, do hereby assign to the sanitary officers and other officers to be appointed under this order their respective duties and functions as follows:—

I. INSPECTORIAL DUTIES.

1. Every sanitary sub-officer who shall observe, or be informed of any matter demanding, in his opinion, attention from the sanitary officer of the dispensary district in which he has discovered the same, shall notify it forthwith to the sanitary officer in writing, specifying the nature of the case in the Form (a) in the Schedule B to this order annexed, and shall preserve a copy thereof in duplicate.

2. Every sanitary officer who shall have been apprised officially or shall otherwise become cognizant of any matter demanding his attention as aforesaid, shall as soon as conveniently may be visit the locality, and if, after due inspection, he finds such matter to involve danger to public health, he shall report thereon to the board of guardians in the form (b) in the said Schedule B, showing the source from which he received the information, and the date thereof, and the date of his visit of inspection; he shall also give a sufficient description of the nature of the case, and the remedy which he recommends to be adopted, and shall preserve a duplicate of every such report.

II. EXECUTIVE DUTIES.

1. The duty of the executive sanitary officer shall be to attend every meeting of the guardians acting as a sanitary authority and to take their directions from time to time on the sanitary business of the board, and on the reports of the sanitary officers, and all proceedings arising thereon, and to see that the same are carried out and brought to a conclusion where practicable, in pursuance of the orders of the board.

2. In furtherance whereof we do hereby direct that every sanitary officer and sub-officer of the union shall, on receiving directions from the executive sanitary officer, attend and assist in all proceedings in which his attendance or assistance may be required.

3. The duty of the consulting sanitary officer shall be to attend meetings of the guardians acting as sanitary authority, whenever required to do so, and to advise them on all matters and proceedings requiring medical knowledge and advice in the administration of the sanitary laws.

4. The proceedings of the board of guardians acting as the sanitary authority shall be recorded in the same manner as the minutes of the proceedings of the board under the Poor Law and Medical Charities Acts, and a copy of such record shall be annexed to the ordinary minutes of proceedings of the board of guardians, and transmitted to the Local Government Board by the clerk of the union, with such last mentioned minutes.

III. STATISTICS OF DISEASE.

It shall be the duty of the consulting sanitary officer and of the sanitary officers to furnish from time to time to the Local Government Board such statistical returns of sickness and disease in the workhouse and its hospitals, and in the dispensary districts, as shall from time to time be required from them respectively.

IV. FIRST MEETING.

The first meeting of the rural Sanitary Authority in each case shall be on the day of the second weekly meeting of the board of guardians after the receipt by them of this order.

SCHEDULE A,

Containing the Names of the Unions to which this Order applies.

Abbeyleix	Celbridge	Kanturk	Newcastle
Antrim	Claremorris	Kells	Newport
Ardee	Clifden	Kenmare	Newtownlimavady
Athy	Clogheen	Kilkeel	Oldecastle
Bailieborough	Clogher	Killadysert	Omagh
Ballina	Clonakilty	Killala	Oughterard
Ballinasloe	Clones	Killarney	Parsonstown
Ballinrobe	Cookstown	Kilmaethomas	Portumna
Ballycastle	Cootehill	Kilmalloe	Rathdrum
Ballymahon	Corrofin	Kilrush	Rathkeale
Ballymoney	Croom	Larne	Roscommon
Ballyshannon	Delvin	Letterkenny	Roserea
Ballyvaghan	Dingle	Lismore	Scariff
Balrothery	Donaghmore	Lisnaskea	Shillelagh
Baltinglass	Donegal	Listowel	Skibbereen
Banbridge	Downpatrick	Longford	Skull
Bantry	Dromore, West	Loughrea	Strabane
Bawnboy	Dunfanaghy	Macroom	Stranorlar
Belmullet	Dungannon	Magherafelt	Strokestown
Borrisokane	Dunmanway	Mallow	Swineford
Boyle	Dunshaughlin	Manorhamilton	Thomastown
Caherciveen	Edenderry	Midleton	Thurles
Callan	Enniscorthy	Milford	Tipperary
Carrickmaeross	Ennistymon	Millstreet	Toberernry
Carrick-on-Shannon	Glennamaddy	Mitchelstown	Trim
Cashel	Glenties	Mohill	Tuam
Castlebar	Glin	Monaghan	Tulla
Castleblayney	Gorey	Mount Bellew	Tullamore
Castlecomer	Gort	Monntmellick	Ullingford
Castlederg	Gortin	Mullingar	Westport
Castlereagh	Granard	Naas	
Castletown	Inishowen	Navan	
Cavan	Irvinestown	Nenagh	

SCHEDULE B. (Forms.)

SANITARY SUB-OFFICER'S REPORT BOOK.

FORM (a.)

To the Medical Officer of
Dispensary District in the
Union.

SIR,
I hereby draw your attention
to

Signed day of 187

Sanitary Sub-officer.

To the Medical Officer of
Dispensary District in the
Union.

SIR,
I hereby draw your attention
to

Signed day of 187

Sanitary Sub-officer.

Local Government Board's Sanitary Orders. 13

FORM (b) (same as in No. 1 Order).

SANITARY ORDER.

No. II. Relating to Rural Sanitary Districts consisting of Parts of Unions of which other parts are Urban Sanitary Districts.

To the Guardians of each of the Unions named in the Schedule A to this Order annexed; to the Medical Officers of the Workhouse and of the Dispensary Districts therein; to the Clerk and other paid Officers thereof; and to all whom it may concern.

Whereas, by the "Public Health (Ireland) Act, 1874," a certain defined part of each of the said unions has been constituted a rural sanitary district, and the guardians of the union are, as such, declared to be the rural sanitary authority for the said rural sanitary district, the other part or parts of the said union having been declared by the said act to constitute some urban sanitary district or districts:

And whereas, by the tenth section of the said act it is enacted that every medical officer of a dispensary district shall be a sanitary officer for such district, or for such part thereof as he shall personally be in charge of, and that every sanitary authority shall appoint in addition such other sanitary officers as the Local Government Board shall in each case direct:

Now we, the Local Government Board for Ireland, do, in the case of each union in the said schedule named, but in respect of such part only thereof as does not consist of some urban sanitary district, direct the guardians to appoint so many sanitary sub-officers as the guardians shall with our consent determine; and we do hereby direct and declare that the relieving officers and the collectors of poor rates shall be alike eligible for the office of sanitary sub-officer for such part of the union as aforesaid.

(The remaining paragraphs are the same as in No. 1 order.)

SCHEDULE A,

Containing the Names of the Unions to which this Order applies.

Armagh, Athlone, Ballymena, Bandon, Belfast, Carlow, Carrick-on-Suir, Clonmel, Coleraine, Cork, Drogheda, Dublin, North; Dublin, South; Dundalk, Dungarvan, Ennis, Enniskillen, Fermoy, Galway, Kilkenny, Kinsale, Limerick, Lisburn, Londonderry, Lurgan, New Ross, Newry, Newtownards, Rathdown, Sligo, Tralee, Waterford, Wexford, Youghal.

SCHEDULE B. (Forms), same as in No. 1 order.

FORM (b) (the same as in No. 1 order).

SANITARY ORDER.

No. III. Relating to Urban Sanitary Districts.

To the Governing Body of each of the Cities, Towns, and Townships named in the Schedule A to this Order annexed; to the Medical Officers of the Dispensary Districts comprised or partly comprised therein; and to all whom it may concern.

Whereas, by the "Public Health (Ireland) Act, 1874," each of the said cities, towns, and townships has been constituted an urban sanitary district, and the governing body thereof has been in each case declared to be the urban sanitary authority:

And whereas, by the tenth section of the said act it is enacted that every medical officer of a dispensary district shall be a sanitary officer for such district, or for such part thereof as he shall personally be in charge of, and that every sanitary authority shall appoint in addition such other sanitary officers as the Local Government Board shall in each case direct:

Now we, the Local Government Board for Ireland, do, in the case of each city, town, and township in the said schedule named, direct the governing body to appoint so many sanitary sub-officers as the said body shall with our consent determine.

(The remaining paragraphs are identical with those in Nos. 1 and 2 orders.)

SCHEDULE A,

Containing the Names of the Cities, Towns, and Townships to which this Order applies.

Armagh, Athlone, Ballymena, Bandon, Blackroek, Bray, Carlow, Carriek-on-Suir, Clonmel, Clontarf, Coleraine, Dalkey, Drogheda, Dundalk, Dungarvan, Ennis, Enniskillen, Fermoy, Galway, Kilkenny, Kilmainham, Kingstown, Kinsale, Lisburn, Londonderry, Lurgan, New Ross, Newry, Newtownards, Pembroke, Portadown, Queenstown, Rathmines and Rathgar, Sligo, Tralee, Waterford, Wexford, Youghal.

SCHEDULE B. (Forms). (Same as in No. 1 order.)

FORM (b.) (Same as in No. 1 order.)

Up to the present the Local Government Board has issued no order relative to Dublin, Belfast, Cork, and Limerick; but it is expected that these cities will each be provided with a superintendent medical officer of health, besides the *ex officio* medical officers of health, and the other health officers specified in the act. So far the public health organization of Dublin remains in *statu quo*; the dispensary doctors are to be officers of health under it, but appointed by the two Boards of Guardians.

SANITARY SUB-OFFICER.

I prefer the homely title of inspector of nuisances by which this officer is so generally designated in the sanitary acts. His duties are important, as with him, to a great extent, rests the detection of most nuisances injurious to health. The following are the duties which he *ought* to discharge:—

House Inspection.—To see that there is no overcrowding—that is, not more than one person for every 300 cubic feet of space in the room. In order to find this out he is to ascertain the number of persons inhabiting the room, and determine its size with a tape measure—by multiplying the length by the breadth, and the product by the height (15 feet \times 10 feet \times 10 feet = 1,500 feet, or accommodation for five persons). To see that the house is in proper repair, that the stairs and banisters are in a safe state, that the roof does not admit the rain, that the windows are glazed, that the floors have no holes—that, in a word, the house in every part is in proper repair, and also in a cleanly condition. He should note the state of the yards—they should be kept clean and well drained. The privies should be provided with doors and roofs, which is often not the case. There should be one privy or water-closet for every four families, at least. Sometimes a dozen cottages are dependant upon one of these places. Should he observe

an offensive odour in the house, he should endeavour to trace it to its source. This is a *most important part* of the work of a health officer. The ashpit should be covered in, and it is desirable to have it provided with a door. Should new privies have to be constructed, directions should be given to have them placed in the least obtrusive situation available. He should frequently inspect dairy yards, stables, slaughter houses, markets, manufactories. If there be accumulations of manure in the dairy-yards, stables, and slaughter houses, he should serve a notice at once upon the owners of the premises, requiring them to remove the manure within twenty-four hours. For this as well as other purposes, he should be provided with portable ink bottle, pens, note-book, and forms of notice. In the case of fish, vegetable, fowl, pig, cattle, horse, hay, and straw markets, the inspector should urge the owners of stands to keep them as clean as is possible under the circumstances. Injurious emanations from manufactories are to be carefully looked for, and if observed, the fact promptly notified to the medical officer of health. In open country districts the removal of manure is not to be required; still, if it is placed in such a close proximity to the house as to be injurious to health, its removal to a less objectionable situation on the premises may be insisted upon. Black smoke, emitted from any chimney other than that of a domestic dwelling, is rendered illegal by the 108th section of the Towns' Improvement Act, 1847. The inspector should see that the owners of factories, breweries, &c., do all in their power to prevent the emission of black smoke. He should note the appearance of the meat, fowl, fish, &c., exposed for sale in shops, or being prepared for sale in slaughter houses, &c., and if they appear to him to be diseased, putrid, or otherwise unsound and unfit for human food, he should seize upon and submit them to the inspection of the medical officer of health. Should he notice a diseased animal which it appears probable is intended to be slaughtered for the purposes of being used as food, he should seize upon it also. In making such seizures, he can generally rely upon the co-operation of the police. In Dublin the inspectors always call upon the first passing policeman to take charge of any diseased meat that they may have seized until they go in quest of the medical officer. It is properly the duty of the inspector to see that the disinfection of premises ordered to be purified by the sanitary authority is carried out; and for this purpose he should procure full and precise directions from the medical officer. Should the inspector learn that any one is suffering from a contagious disease, he should forthwith report the circumstance to the medical officer. He should urge upon the humbler classes within his district the importance of having their young children vaccinated at the proper time; and he should caution them against the perils of small-pox inoculation when such a practice is known to exist in his district. He should warn persons in whose houses or lodgings there had been cases of contagious disease that they cannot let or re-let them until after their

thorough disinfection, under a penalty of £5; and he should caution persons suffering from infectious complaints that they are liable to a penalty if they mix in a crowd, use public conveyances, or otherwise needlessly expose persons to contagion. The inspector—though it is not strictly his business to do so—should aid in securing more accurate returns of births and deaths by reporting all that he is aware of to the registrar of the district. It is most important that the inspector should record in his book his observations in ink writing at the time that he is making them. In his inspections his manner should be very civil, but, at the same time, firm; for he is protected in the exercise of his functions by several sections of the Sanitary Acts.

Bake-houses should be occasionally visited by the inspector. (See 26 & 27 Vic., c. 40.)

Under the Adulteration of Food Prevention Act of 1872 it is the business of the inspector (when so appointed, and when there is a public analyst for his district) to collect articles of food, drink, and drugs, and submit them for examination to the analyst; he is also to receive from persons who desire to use the services of the analyst specimens of food, &c., and to deliver a portion of the same to that officer, and to retain a portion for re-examination, if necessary. (See chapter on food adulteration, and the acts relating thereto:—23 & 24 Vict., c. 84, and 35 & 36 Vict., c. 78, in the compendium of acts annexed.) The inspector of nuisances should study the sanitary acts given in this work and in which he will find his duties and powers frequently referred to.

MEDICAL OFFICER OF HEALTH.

According to the Public Health Act of 1874, every dispensary medical attendant is, in virtue of that position, a medical officer of health. His duties in the latter capacity are not at present minutely defined by orders of the Local Government Board, but presumably are as follows:—To make himself acquainted with the topography of his district, the nature of its rock formation and soils, the position of its drains and sewers, and the direction towards which its drainages flow; to become acquainted with the social condition and habits of the humbler classes, and the nature of their employments; to ascertain the nature of the manufactures (if any) carried on in the district, with the view of determining their action upon health; to ascertain by analysis (performed by himself or the public analyst, if there be one, or any competent chemist) whether or not the potable water is of good quality, and available in sufficient quantities; to discover whether or not water is polluted, and if so, in what way, and by whom; not relying solely upon information supplied to him by the sanitary sub-officers or others, to personally inspect the houses, in order to ascertain whether or not they are overcrowded, untenable, provided with sufficient accommodation in the shape of ashpits, &c., and to inquire generally into their sanitary condition; to investigate into the causes of

sickness, not merely arising from zymotics, but from any cause that may be preventable by hygienic means—such as bronchitis, rheumatism, &c.—with the view to remove or diminish them; to inspect food suspected to be unfit for use, and, if found to be so, to procure a magistrate's order for its destruction; to give immediate notice to the Local Government Board and the local Sanitary Authority of any outbreak of disease; to adopt every legitimate means within his province whereby the public health may be improved, and to submit suggestions to that effect to the general and local sanitary authorities; to ascertain whether or not the burial grounds are properly kept, and the interments therein effected in such a way as not to affect the public health; to advise with respect to the removal of persons suffering from contagious disease to hospital; to give instructions to the sanitary sub-officer as to the proper mode of disinfecting premises, bedding, and clothing, likely to be the vehicle of contagion; to keep, if possible, a registration of disease, as well as of deaths and births; to attend promptly to every sanitary matter brought under his notice by the sanitary sub-officer or other official; to record his observations in relation to sanitary matters at the time they are made—not in pencil, but in writing, in a book kept for that purpose.

The medical officer should never conduct a prosecution, nor appear in court in any other capacity than that of a skilled witness; still, he might privately confer with the Sanitary Authority and officers on all—even the legal—bearings of a case. It is to be supposed that he will study the sanitary laws, and that he will frequently, during his reading, learn the decisions of the courts in sanitary cases; therefore, he may properly, in very many instances, express an opinion as to the proper legal redress for sanitary evils.

When a medical officer of health certifies as to the existence of a nuisance, he is commonly called upon to suggest a remedy for it. In the case of overcrowding, deficient sanitary accommodation, accumulations of manure, and similar nuisances, the remedies are obvious; but when the evils complained of are the evolution of black smoke, the exhalations from chemical works, &c., he should be slow to suggest a remedy. If he should do so, and that it proved a failure, it would be difficult to procure from the magistrates a second order for the abatement of the nuisance. In reality, the *onus probandi* in such cases rests on the committer of the nuisance, and not with the health officer. The former is bound to abate the nuisance in the best manner he can, or to show that he has done all in his power to lessen the evil. At the same time, if the medical officer is certain that he can indicate a method whereby a particular nuisance could be abated, he ought to explain it.

MEDICAL SUPERINTENDENT OFFICER OF HEALTH, OR
CONSULTING SANITARY OFFICER.

The Public Health Act of 1874 empowers each local authority to appoint, if required to do so by the Local Government Board, a medical superintendent officer of health. In the orders issued to the local authorities by the Local Government Board, the former are directed to elect a consulting sanitary officer; and this officer, I presume, is the equivalent of medical superintendent officer of health. The duties of this officer are briefly defined in the order of the Local Government Board. I cannot help regretting that the Public Health Act of 1874 does not provide for the appointment of a consulting, or rather superintendent, medical officer of health for every district containing 100,000 inhabitants and upwards. I have the greatest respect for the Irish dispensary physicians—they are a medical corps of which any nation might be proud; but still the great majority of them have not devoted their attention to sanitary science. In the year 1867, in a course of lectures on Public Health, delivered in the Royal College of Surgeons, I strongly advocated the employment of the dispensary physicians as medical officers of health; but, at the same time, I insisted upon the importance of having a small number of highly skilled sanitarians employed as superintendent health officers.

Under the order of the Local Government Board it is still open to urban and rural authorities to unite or agree in appointing the same person as consulting sanitary officer for several districts. Such an officer should be debarred from private practice, but might be permitted to hold such appointments as the following:—Medical Officer to an Hospital or other public institution, Professor or Lecturer in a University or Medical School, Medical Inspector under the provisions of the Contagious Diseases Prevention, the Merchant Shipping, or the Factory Acts, or Inspector under the Alkali Nuisance Prevention Acts. For two years before the passing of the Public Health (Ireland) Act, many students, and even graduates in medicine, speculating on the probability of employment being created under some such measure, had been qualifying themselves for appointments as sanitary officers. One gentleman, of high medical attainments, has worked with me for nearly two years with the sole object of acquiring full information to enable him to act as a health officer, pure and simple. He and others like him are disappointed with the Public Health Act of 1874.

I consider that the medical officer of health should confer with the consulting sanitary officer on all important matters relating to epidemics and nuisances, and the means for their abatement, before submitting his report thereon to the sanitary authority. In all serious nuisance cases, where law proceedings are necessary, the evidence of the sanitary and sub-sanitary officers in court should be strengthened by that of the consulting sanitary

officer. It is only fitting that the general report on the sanitary condition of the district, written for publication, should be the work of the consulting health officer.

EXECUTIVE SANITARY OFFICER.

It is probable that the Town Clerk, or the Clerk or Secretary to the Towns or Townships Commissioners, and the Clerks to the Unions, will be the executive sanitary officers in most cases; but occasionally a special assistant to the clerk, &c., or a surveyor, may be appointed to the office. His duties are fully defined in the sanitary orders of the Local Government Board. It will be his duty to keep an accurate account of all the transactions of the local authority relating to sanitary matters, and a record of the orders of magistrates relative to the abatement of nuisances, and of the penalties and costs imposed under the sanitary acts, including food adulteration and petroleum acts. In important cases, where the sanitary authorities order prosecutions to take place, the executive sanitary officer should see that the summonses are properly filled, and should attend in court on behalf of the sanitary authorities and conduct the prosecution. In very important cases he should, with the sanction of the sanitary authorities, procure legal advice and assistance. In trivial cases the sanitary sub-officer ought to be intelligent enough to act without any assistance other than the medical officer's certificate, or, when necessary, oral evidence. It will often be found desirable to combine in one person the duties of surveyor and executive sanitary officer. Mr. Boyle, the secretary to the sanitary authority of the City of Dublin, is a civil engineer, and often gives skilled evidence relative to the construction of drains, &c., and the erection of works for the effectual abatement of nuisances. The executive officer should see that the penalties and costs imposed for breaches of the sanitary acts are lodged to the credit of the sanitary authority. The fines, however, imposed under the acts for the prevention of food, drink, and drugs adulteration are payable, in cities having a separate court of quarter sessions, to the town councils; in counties, to the grand juries.

CHAPTER III.

NUISANCES.

We might say of dirt that which Morgagni said of a *slight cold*: *Omnium prope quibus affligimur morborum origo et quasi semen.* Dirt, or "matter out of place," constitutes in one shape or other nearly every kind of nuisance with which the sanitarian has to grapple. Dirt in water, dirt in air, dirt in clothes, dirt on the person, dirt heaps in and near the dwelling, are prolific sources of disease, but the most easily preventable. If the sanitary authori-

ties could only succeed in inducing people to keep themselves and their dwellings clean, what a large amount of disease would there not be thereby prevented! The health officers find dirt to be their greatest opponent. They often vanquish, but never extirpate it. It is always making its appearance, and will always afford plenty of employment for the officers of health, and more especially for the inspectors of nuisances.

A nuisance, in the widest acceptance of the term, means anything which causes injury or annoyance to a neighbourhood or to an individual. Thus, to partially or wholly exclude light from a room or a dwelling, by building a wall close in front of it, is a nuisance. A disagreeable odour, though it may not be proved to be actually injurious to health, is a nuisance, because it renders a person or persons uncomfortable. A perpetual and loud noise is a nuisance. In general, however, magistrates who have cases brought under the provisions of the sanitary acts only convict when it is proved that the nuisance complained of is injurious to health. Thus, a Dublin police magistrate refused to order the abatement of a nuisance caused by the erection of a row of privies opposite a terrace of dwelling-houses, on the ground that though such an act was improper, yet it did not constitute a nuisance injurious to health.

*Overcrowding.*¹—In the General Improvement and Police (Scotland) Act, 1862, it is enacted that the minimum space for living in shall be 150 cubic feet for children under 8 years old; and 300 cubic feet for persons above that age. In the Sanitary Act of 1866, although power is given to prevent overcrowding, no mention is made as to the minimum space for each person. In England the space considered sufficient is 240 cubic feet, and 30 square feet under the Metropolitan Lodging Houses regulations; and 300 cubic feet for each person in dormitories, under the Local Government Board regulations. In Dublin the minimum space permitted to dwell in, day or night, is 300 cubic feet—which is by no means excessive.

The medical officer can certify as to overcrowding in the case of *any* house, whether let in lodgings or not. In determining the space sufficient for a family, the sanitary officer should consider not merely the size of the room, but its provision for ventilation, the quantity of furniture contained in it, and the situation of the house. If the ventilation be deficient, more cubic space will be necessary, as will also be the case when the room is crowded with large bedsteads and other bulky articles of furniture. If the house be in a narrow court the cubic space in it per head should be greater than if it were isolated from other dwellings and buildings, and surrounded with pure air.

The following, which is a copy of an actual report of mine,

¹ 10 & 11 Vict., c. 34; 18 & 19 Vict., c. 121; 29 & 30 Vict., c. 90; 31 & 32 Vict., c. 133.

addressed to the Pembroke Township Commissioners,¹ will serve to illustrate the general mode of reporting on nuisances.

At the corner of street, in the house occupied by there is a nuisance of a very serious character. In the yard attached to the house, and which is only about 10 feet wide by 12 feet in length, there is a pig-sty containing three very large pigs. The sty is within two feet of the lower back window of the house, and is immediately overlooked by a window of a room in the upper story, in which part of the house there are lodgers. The odour in this little yard is simply abominable, and can be distinctly and very unpleasantly felt by the passers by on the roadway. The place is utterly unfitted for keeping pigs in, and they should be forthwith removed.

Donnybrook.—Six houses have a rather small yard in common. The houses are occupied by nine families, comprising 27 persons. There is but one privy for all these persons, and that not very clean, and unprovided with a fastening. Such a place could not, with decency, be used by females. The yard is very dirty, and the only drain is a groove in the surface of the ground, which to some extent may be regarded as a miniature cesspool. There is a supply of Vartry water, but the tap is placed against the wall of the house, thereby rendering the inner surface of an inhabited room very damp. The tap should have been placed on a thick pilaster on a stone or brick pillar. Remedies: a second privy, a new and covered drain, a thorough cleansing of the yard and whitewashing of the walls. It would be necessary also to interpose between the water pipe and tap and the house wall a layer of hydraulic cement.

Privies and Ashpits.—The privies of the dwellings of the lower classes are generally kept in a most filthy and offensive condition, and their interiors are usually fully exposed to view. The accommodation which they afford is sometimes inadequate—a whole court or alley of houses being dependant on a single privy, whereas there should at least be one for every four families. Dirty privies and insufficient privy accommodation are nuisances of the most common occurrence. The ashpit is a nuisance when it is too full, and when it is not covered in. The 39th section of the Public Health Act, 1874, enables the Local Government to cause the urban sanitary authorities to cleanse the ashpits, privies, and cesspools of the private houses situated within their districts. It is to be hoped that the local authorities will not wait until they are put in motion by the higher power, but that they will at once undertake the domestic scavenging of their respective districts. The cleansing of the streets and the removal of house refuse might be carried on simultaneously. It would be most desirable if the yards and out-offices of the houses occupied by the lower class were cleansed every day. I have repeatedly urged upon the governing body of the Pembroke Township the great sanitary advantages which would result if they undertook the domestic scavenging of this district; and I have calculated that a rate of twopence in the pound would produce a sum more than sufficient to pay for the removal of the effete matter from all the houses in the township. I

¹ I may remark that this township, which contains 21,000 inhabitants, is kept in a very cleanly condition; but in the best regulated places nuisances will appear from time to time.

venture to assert that few persons would object to the slight taxation necessary to have their ashpits, and refuse receptacles generally, systematically cleansed. In many parts of England the private scavenging is now performed by the sanitary authorities. Amongst the many useful sanitary arrangements in force in New York is one which directs the application of a deodorizer to night soil before its removal.

Dr. Trench, the able Medical Officer of Health for Liverpool, stated some years ago that he would certify against

1stly. Midden-privies inside houses. 2ndly. Midden-privies emptied through houses. 3rdly. Midden-privies situated beneath rooms. 4thly. Tunnel middens of every description. 5thly. Combined open middens supplying many tenements and placed near to inhabited rooms. 6thly. Midden-privies of private houses clustered together in a *cul-de-sac*. 7thly. Midden-privies of private houses in close, confined yards or situated beneath windows, or abutting on the walls of houses, or within two feet of the lower windows, or of the door of the house. 8thly. Midden-privies of courts. 9thly. Midden-privies abutting on or opening directly into streets and thoroughfares, and emptied before the doors and windows of houses. 10thly. Midden-privies of front houses when emptied through a court. 11thly. Midden-privies beneath the footpath of the street and emptied through a grid on the footpath. 12thly. Midden privies of many houses, when collected together as a kind of amphitheatre, as is seen in particular groups of streets.

Midden and cesspool mean much the same thing.

*Tenantable Condition of Houses.*¹—I have already referred to this subject under the head of Duties of Health Officers. It is difficult to prevent houses from being overcrowded and dilapidated. The owners of tenement houses do not, as a rule, expend a penny on repairing or cleaning them that they can possibly avoid. They generally resent the interference of the health officer, and in a large proportion of cases legal steps are necessary to oblige them to abate the nuisances which he discovers. The occupants of the houses are also often averse to the visitations of the inspectors, especially when their rooms are overcrowded. Increased accommodation to them means increased rent. Houses and rooms in a dilapidated state are a nuisance. Very dirty² houses are also a nuisance, and the magistrate may direct them to be whitewashed or otherwise cleansed, should the owners refuse to do so when requested by the sanitary officer.

Any house in which a zymotic disease has repeatedly broken out may be regarded as dangerous to health. A magistrate's order should be applied for to close such a house until such time as, by disinfection, cleansing, or structural works, it may, in the opinion of the medical officer of health, be deemed fit for re-habitation.

Cellars built since August, 1848 (the date of the passing of a Public Health Act), cannot legally be held as separate dwellings; nor can any underground room be let or occupied as such, unless it be 7 feet high, its roof 3 feet above the street level, and pro-

¹ 29 & 30 Vict. c. 9, section 35, and 31 & 32 Vict., c. 130, sec. 5.

² 11 & 12 Viet., c. 93, sect 60.

vided with an area $2\frac{1}{2}$ feet wide in every part, besides being furnished with privy accommodation, drains, &c. (11 & 12 Vict., C. 63, S. 67; and 29 & 30 Vict., c. 90, s. 42).

Animals.—Oxen, horses, pigs, asses, goats, and fowls kept in a house are, undoubtedly, nuisances injurious to health; but in purely rural districts it will be difficult to induce small farmers and labourers to regard them in any such light. In towns, and even in villages, the medical officer should be strict in demanding the separation of human beings and the lower animals. Section 25 of 11 & 12 Vict., c. 63, expressly prohibits the keeping of pigs in dwellings, or at all, unless in such a manner that they shall not be a nuisance to any one. The medical officers have much trouble in dealing with piggeries. I think they should certify that they are a nuisance when kept in a filthy condition or in a small yard surrounded by dwellings, or in any yard, large or small, not properly sewered and paved. Many magistrates have expressed an opinion that swine should not be kept in towns under any circumstances, and have invariably given orders for their removal on the application of the sanitary authorities. Should the sanitary authorities and their officers decide to permit swine to be kept within their districts, it should be only on the following conditions:—That the sties be at a distance of at least eight yards from the nearest dwelling, that they be kept thoroughly clean, that the manure produced in them be frequently removed, and that they be paved and sewered. Where horses, cows, asses, goats, fowls are kept close to dwellings, their sanitary condition should be frequently inspected, and, if they become a nuisance, dealt with accordingly. Dairy-yards in a filthy condition and with insufficient accommodation for the animals kept therein, and slaughter yards unpaved and kept in a filthy state, are nuisances which often call for vigorous action upon the part of the health officers.

*Manure and Filth.*¹—Heaps of manure are serious nuisances. Their owners should be noticed to have them removed within twenty-four hours, and if they fail to do so proceedings should be taken to compel them to abate the nuisance. Ponds of stagnant water in yards or close to dwellings are clearly a nuisance.

*Black Smoke*² emitted from chimneys, except those of dwellings, is a nuisance, but one which it is often very difficult to deal with. Many manufacturers really do their best to abate this nuisance, but with only partial success. They should, however, be compelled to have high chimneys, to carry up the smoke far above the highest windows of dwellings, and they should prove that their furnaces are the best procurable for the purpose of consuming their smoke, or rather for the purpose of not generating black smoke.

Effluvia from Chemical Factories are a nuisance, but of a nature very difficult to deal with. When there are several works in the same neighbourhood, it is sometimes impossible to fix upon

¹ 11 & 12 Vict., c. 63, sections 53 and 59

² 10 & 11 Vict., c. 34, sec. 108.

that which produces the nuisance complained of. All works in which sulphuric acid, muriatic acid, nitric acid, bleaching powder, and salt cake are produced are under the supervision of inspectors of alkali works; but if the medical officer can distinctly trace any offensive and dangerous effluvium to any such works, the owner is liable to be prosecuted under the Sanitary Act.

Bone Boiling and soap and candle making are processes which frequently produce emanations injurious to health. These processes should be conducted in close places and in such a way that any noxious effluvia produced may be passed through a furnace and from thence sent into the atmosphere through a high chimney. The mode of dealing with nuisances arising from ammonia works, &c., is explained in the chapter on Pollution of the Atmosphere.

Gas Works sometimes produce a nuisance either at the place where the gas is manufactured or by leakages from the mains.

Bad Odours in a dwelling or its yard, proceeding from a defective sewer, are nuisances of frequent occurrence.

Steam Whistles used in factories for the purpose of awakening the workpeople in the early morning are a nuisance, as they frequently disturb the sick and annoy the healthy. They are dealt with by 35 & 36 Vict., c. 61, s. 2.

In Section 19 of 29 and 30 Vict., c. 90, and sec. 8 of 18 and 19 Vict., c. 121, there are definitions of nuisances given

CHAPTER IV.

VITAL STATISTICS.

It seems an inexorable law of nature that at least 11 human beings out of every 1,000 living must die every year. As a matter of fact, from 15 to 40 per 1,000 perish, the variation in the numbers being chiefly, sometimes solely, produced by local causes. In the United Kingdom about 21 persons die annually out of every 1,000. Sanitary science has but two objects to accomplish—to reduce to the normal number mortality from disease, and to diminish the amount of sickness. That the number of persons perishing annually from disease so considerably exceeds the *inevitable number* above-mentioned is sufficient evidence that sanitarians have a vast work before them, as important, difficult, and onerous as any that concerns mankind in matters temporal. To enable sanitarians to estimate the amount or rather the result of their work, accurate statistical information relative to the number of deaths and births, and the amount and nature of present disease, is of the highest degree of importance. Unfortunately, there is no registration of disease in these countries; but we have records of the births and deaths

which, though not absolutely accurate, are of the highest value to sanitarians.

Very few people die from old age, yet that is the natural termination of man's life. In the mortality returns a small proportion of the deaths is officially ascribed to "accident;" but a larger number really results from accidental causes. If a strong and healthy man be poisoned with sewer emanations, and die from typhoid fever, surely that circumstance would be an accident! Every death from a preventable disease is an accident, and not a natural and inevitable event. Nor are all the maladies termed "constitutional" necessarily inherent in man's nature: most of them are the results of privation, hardship, intemperance, gluttony, and immorality. Many of them are produced by breathing bad air and drinking foul water. They not only originate in our own faults and misfortunes, but we also inherit them from our ancestors; for the effects of the sins and mishaps of men afflict their children "even unto the third and fourth generation."

The mean period of the life of the people is the best test of the condition of the public health. In England the average duration of human life is 39·91 years in the case of males, and 41·85 in that of females. In Scotland the duration of human life is somewhat longer than in England. In Ireland the vital-statistics collected are somewhat unreliable. In some districts the mortality is much greater than in others. During the ten years ended in 1867 the average death-rate in the districts of England containing the chief towns, and including a population of 11,000,000, was 23·89 per 1,000 persons living. During the same period in the smaller towns and country parishes, containing a population (in 1861) of 9,135,383, the rate of mortality was 20·08 in every 1,000 persons living.

In every 1,000 deaths in these islands, nearly one-fourth occur from zymotic diseases; more than one-third from local maladies—inflammations and functional diseases of the heart, lungs, and other organs; 180 from "constitutional diseases," such as phthisis, gout, and dropsy; and nearly all the rest—chiefly of children and aged persons—are caused by developmental diseases, such as debility. About 30 deaths per 1,000 occur from violence—murders, suicides, and accidents. Half the number of deaths of young women between the ages of 20 and 30 years are caused by consumption. In some parts of England the death-rate is so low as 15 per 1,000 living; in others it rises to from 30 to more than 40.

According to Mr. Ratcliffe, rural labourers have on the average 45·32 years to live; carpenters, 45·28 years; domestic servants, 42·03 years; sawyers, 42·02 years; bakers, 41·92 years; shoemakers, 40·87 years; weavers, 41·92 years; tailors, 39·40 years; hatters, 38·91 years; stonemasons, 38·19 years; plumbers, 38·13 years; mill operatives, 38·09 years; blacksmiths, 37·96 years; bricklayers, 37·70 years; printers, 36·66 years; clerks, 34·99 years; population of England and Wales, 39·88 years. The rela-

tive mortality in these trades is not constant at all ages; for example, a printer at 60 years of age has a mean expectancy of 12.04 years; whilst, at the same age, a bricklayer's expectancy of life is only 8.44 years. As a general rule, the average relative mortality amongst persons following different pursuits is very closely maintained at all periods of life.

It is a melancholy reflection that one-half of the human family perish before the age of puberty, and chiefly from causes brought into operation by man himself. In the healthiest of the larger cities of the United States, Philadelphia, no less than 42.72 of the deaths in 1873 were amongst children under 5 years.

In England 4,650 per cent., and in France 7.3487 per cent. of the children born die during the first month of their existence. In the former country 14.9493 per cent. of the children born perish before they enter upon a second year of life.

TABLE SHOWING EXPECTATION OF LIFE AT DIFFERENT AGES, IN A HEALTHY DISTRICT, ACCORDING TO DR. FARR.

Age (or past life- time).	MALES.		FEMALES.	
	Mean after-life- time of males aged.	Mean age at death of males actually living aged	Mean after-life- time of females aged	Mean age at death of females actually living at the age <i>x</i> .
0	48.56	48.56	49.45	49.45
5	54.39	59.39	53.93	58.93
10	51.28	61.28	50.88	60.88
20	43.40	63.40	43.50	63.50
30	36.45	66.45	36.35	66.85
40	29.29	69.29	30.00	70.00
50	22.03	72.03	22.87	72.87
60	15.06	75.06	15.69	75.69
70	9.37	79.37	9.85	79.85
80	5.37	85.37	5.64	85.64

Mr. Neison states that persons of intemperate habits, aged 20 years, live on the average to be $35\frac{1}{2}$ years; and if they are 30 years, their mean expectation of life is 13.80 years. He calculates that the average duration of life after the commencement of intemperate habits is 21.7 years amongst the beer drinkers, and 16.7 years amongst the spirit drinkers.

M. Quetelet, the Belgian statistician, presented a report on the vital status of European countries to the Statistical Congress assembled at Florence in 1867. The table shows the birth and death rates per 10,000 inhabitants in various States, arranged from Quetelet's report:—

	Births.	Deaths.		Births.	Deaths.
France	... 255	.. 232	Denmark	.. 329	.. 214
Belgium	.. 303	.. 226	Spain	.. 366	.. 276
Bavaria	.. 325	.. 281	Austria	.. 369	.. 275
Sweden	... 326	.. 210	Prussia	... 398	.. 262
Holland	... 327	.. 247	Russia	.. 412	... 274

According to Levy and other authorities, marriages and births are less amongst Jews than Christians; but the longevity of the former is greater. Dr. Glötter states that the mean duration of life amongst Germans is 28·5 years; Hungarians, 23·11; Croats, 22·1; Jews, 30·2. Mayer¹ gives the mean duration of life amongst Jews at 37 years; amongst Christians, 26 years.

In England there are, on the average, five children to each marriage. The richer classes have fewer children than the poorer. Very youthful marriages are not conducive to longevity. In England the number of children annually born is about one to every twenty-nine persons living.

Mr. Radcliffe, in his observations on the rate of mortality existing among friendly societies (Manchester, 1850), gives the following table:—

England and Wales— Rural, Town, and City; and various Trades.	Aoe.				
	20	30	40	50	60
England and Wales ...	39·88	33·13	26·56	20·02	13·59
Manchester Unity ...	40·32	33·70	26·41	19·40	13·29
Bakers ..	41·92	34·05	26·58	20·09	14·12
Blacksmiths ..	37·96	30·34	23·52	18·11	13·02
Bricklayers ..	37·70	29·66	22·22	14·78	8·44
Butchers ..	41·60	33·49	26·33	20·32	14·89
Carpenters ...	45·28	38·47	31·65	25·07	18·88
Clerks ...	34·99	27·77	20·61	14·18	12·11
Coopers ...	38·02	31·17	24·23	18·22	13·23
Dyers ...	39·89	32·60	24·73	18·20	13·40
Hatters ...	38·91	34·29	27·93	19·87	12·39
Labourers (Town and City) ..	40·87	33·65	26·27	19·07	13·33
" Rural ..	45·32	37·71	29·91	22·18	15·82
Millwrights ..	40·32	33·38	27·37	19·60	13·69
Mill Operatives ..	38·09	30·45	22·61	15·55	10·61
Miners ...	38·22	31·65	24·28	17·82	12·27
Plumbers ..	38·13	31·59	24·67	18·24	12·67
Potters ...	36·59	30·51	23·80	18·74	13·71
Printers ...	36·66	28·86	20·55	14·67	12·04
Sawyers ...	40·02	33·06	26·05	18·04	13·11
Servants, Domestic ..	42·03	34·30	27·32	20·77	14·81
Shoemakers ..	40·07	33·99	26·23	19·04	13·05
Spinners ..	39·04	32·42	24·32	16·62	12·21
Stonemasons ...	35·19	30·41	24·16	18·05	14·79
Tailors ..	39·40	32·51	25·34	18·31	10·23
Weavers ..	41·92	35·55	28·53	22·01	15·61
Wheelwrights ...	40·07	33·87	27·54	19·41	13·84
Wool-combers ..	38·56	33·73	25·96	17·64	13·22

Influence of Marriage on Health.—Levy, Motard, Londe, Tracy, Broussais and several other vital statisticians agree in attributing to matrimony a beneficial effect on life and health.

At a meeting of the French Academy of Medicine, held on the 14th of November, 1871, M. Bertillon discussed this subject in an elaborate paper on diseases. His statistics chiefly apply to France,

¹ Deutsche Zeitschr. f. d. Statistik, t. xxi., p. 2. 1862.

Belgium, and Holland. From 25 to 30 years of age, the married men die at the rate of 6, the unmarried 10, and the widower 22 per 1,000 per annum. From 30 to 35 years, the deaths amongst these classes are respectively 7, 11, and $19\frac{1}{2}$ per 1,000, and from 35 to 40 years, $7\frac{1}{2}$, 13, and $17\frac{1}{2}$ per 1,000. At greater ages the same favourable difference exists in the case of the Benedicts *versus* the Celibates. It is curious that widowers are more likely to die than men of the same age who have never been married. The exceptions to the low mortality amongst Benedicts are only in the case of those who marry very early in life. It is rather startling to youthful worshippers at the shrine of Hymen to be informed that married *men* from 18 to 20 die as fast as men aged from 65 to 70. Amongst women marriage is not quite so favourable to longevity. No effect is observed until after the age of 25 years. Spinsters from 30 to 35 die at the annual rate of 11 per 1,000; wives in the ratio of 9 per 1,000. The mortality is greater in the case of wives under 25 years than of spinsters below that age. After 40 years the longevity of married women is much greater than that of unmarried females of corresponding ages. Middle-aged widows do not live so long as middle-aged spinsters or wives. M. Bertillon shows that, according to the doctrine of chances, or rather probabilities, a man who marries at 25 years is likely to live 40 years longer, whilst his chance of living so long, if he do not marry, is reduced by five years. On the other hand, a woman who marries at 25 years is likely to attain the age of 65, whilst if she remain single, she will only attain the age of 56 years.

According to Bertillon, crime is most rife amongst the unmarried, and least amongst the married. The widowers and widows are not nearly so bad as those who are unwedded, but they are not (of course, speaking only of averages) quite so virtuous as those who are actually in the state of wedlock. On the whole, M. Bertillon's statistics are most cheering to the intending Benedicts.

In the manufacturing districts of England the bad influence of early marriages is rendered painfully evident by the wretched stunted children who are to be met with in every direction; for there children are the mothers of children, and couples are to be met with whose united ages do not exceed thirty years.

In the report of the Board of Health for Philadelphia, 1873, the following conclusions are deduced from the vital statistics of one city:—

The probabilities of marriage under twenty years are about forty-two times as great with females as with males; between twenty and twenty-five they are more nearly equal, though still in favour of females; but after the twenty-fifth year is passed the probabilities of marriage are always in favour of males, and the proportion increases throughout the remaining periods of life. Between twenty-five and thirty they are 1.21 times as great with males as with females; between thirty and forty, 1.83

times as great; between forty and fifty, 2·09 times; between fifty and sixty, sixty and seventy, seventy and eighty, and eighty and ninety, they are, respectively, 3·4, 6·22, 0·5, and 0·1 times as great with males as with females.

The chances of females being married before the age of twenty years are as *one to five* of all the probabilities that they will ever marry. At the age of twenty years *one-fifth* of all their chances are gone. At twenty-five a little over *two-thirds*, and at thirty nearly *six-sevenths* of all their probabilities are lost. After passing the age of forty a female has a very slight chance of ever being married, over *twenty-thirtieths* of all her chances being lost.

At the age of twenty the chances of males being married are scarcely at all lessened. At twenty-five there are still *three-fifths* of their chances remaining. From this period on they diminish, but in a smaller proportion than with females.

The period of life between twenty and twenty-five years is the most favourable for marriage for both sexes. The next most favourable period for females is that under twenty years; and for males, that between twenty-five and thirty.

In the third Morisonian lecture, delivered in March, 1872, by Dr. Austen Mitchell, before the Edinburgh College of Physicians, the subject of marriages between persons of consanguinity was treated at great length. The lecturer disapproved of marriages between near relatives. He did not, however, believe that the evil resulting from such unions arose from any mysterious influence intrinsic in the consanguinity itself. The danger, in his opinion, was due to the increased risks in such marriages of the transmission of abnormal peculiarities. For example, if a deaf mute is married to a person endowed with the attributes of hearing and speaking, the chances of their having a deaf-mute child will be as 1 is to 135; but if deaf-mutes intermarry, the chances that their offspring will be equally defective will be as 1 is to 20. Most authorities, however, disapprove of marriage between near relatives.

VITAL STATISTICS OF UNITED KINGDOM FOR 1873.

In the latter part of the year 1870 an epidemic of small-pox broke out in England, and continued with virulence during the entire of the year 1871; spreading to Scotland and also to Ireland, which it reached in the latter part of the year 1871. As many as 1,350 deaths from this loathsome disease were registered in the Dublin district during 1871; 871 in Cork; and 204 in Belfast, &c. As this epidemic was a disturbing cause to the general mortality of 1871 and 1872, I select in preference the year 1873 for comparison as to the annual death-rate of the three parts of the United Kingdom. The population of the United Kingdom, estimated to the middle of the year 1873, was 32,131,488; that of England and Wales amounting to 23,356,414; of Scotland, to 3,430,923; and of Ireland to 5,344,151. The number of deaths registered during 1872 in England and Wales afforded a proportion of 21·2 in every 1,000 of the population; in Scotland, 22·4 in every 1,000; and in Ireland, 18·3 in every 1,000. The following table shows, by quarterly periods, the number of deaths from the seven principal zymotic diseases registered in England and in Ireland during the year 1873:—

Diseases.	England and Wales.						Ireland.					
	Quarters.				No. of Deaths.	Rate per 100,000 of the Population.	Quarters.				No. of Deaths.	Rate per 100,000 of the Population.
	1	2	3	4			1	2	3	4		
Small-pox ..	1084	722	277	240	2332	10·0	159	220	30	72	481	9·0
Measles ...	1204	1524	1180	3233	7141	30·5	491	315	214	139	1159	21·7
Scarlatina ...	2644	2088	2593	5556	12901	55·2	426	376	408	829	2039	38·2
Diphtheria ..	579	460	502	719	2200	9·6	93	61	71	129	354	6·6
Whooping Cough	2935	2575	1666	1863	9039	38·7	483	428	433	592	1936	36·2
Fever ..	3402	2883	3053	3810	13148	56·2	861	958	612	640	2071	57·5
Diarrhœa ..	1854	2018	13925	3439	21236	90·9	614	576	657	450	2297	43·0
Total ..	13702	12270	23196	18889	68057	291·4	3127	2934	2425	2851	11337	212·4

From the foregoing table it will be seen that the deaths in England and Wales from the seven zymotic diseases named amounted to 68,057, or 291·4 in every 100,000 of the population, whilst in Ireland they amounted to only 11,337, or 212·4.

The most fatal of these diseases, both in England and Ireland, were diarrhœa, fever, and scarlatina; but in England diarrhœa was much more fatal than fever. In Ireland the reverse was the case. Of the 493,993 deaths in England during 1873, as many as 123,811, or 24·9 per cent., were of children under one year old, whereas in Ireland only 14·1 per cent. were of this age; and in England only 126,224, or 25·6 per cent, had attained their sixtieth year, whereas in Ireland 41 per cent. of the persons whose deaths were recorded had reached this age. Although it is generally supposed that the registration of deaths in Ireland is defective, this goes far to show that the death-rate in Ireland is occasionally lower than in England.

I have been unable to include Scotland in the foregoing table, as the "general abstract" issued by the Registrar-General for that country does not contain information as to the cause of death or age at death, except as regards those which occurred in the eight principal towns.

In England inquests were held during the year 1873 on the bodies of 26,100, being equal to 1 in every 19, or 5·3 per cent. of the persons whose deaths were registered. In Ireland 2,757 inquests were held, only affording a ratio of 1 in every 35, or 2·8 per cent. of the total deaths.

The number of persons who died in public institutions in England during 1873 amounted to 37,630, or 7·6 per cent. of the total deaths. In Ireland the number was 14,699, or 15 per cent. of the deaths registered.

The following table shows the estimated population in 1873, the deaths from all causes, and the deaths from seven zymotic diseases in the great centres of population in the United Kingdom :—

Table showing the Deaths in 1873 in the principal Towns in the United Kingdom, distinguishing the Deaths caused by Zymotic Diseases, &c. :—

Towns.	Estimated Population in 1873.	No. of Deaths from all Causes.	Deaths from the undermentioned Diseases—							Death Rate per 1,000 Inhabitants.	
			Small-pox.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Fever.	Diarrhoea.	From the foregoing 7 diseases	From all Causes.
ENGLAND.											
London ..	3,356,073	76,634	115	2195	652	306	2689	1549	3879	3·4	22·8
Portsmouth ...	118,280	2194	48	16	11	15	17	100	109	2·7	18·6
Norwich ..	81,677	1787	1	8	5	2	20	61	80	2·2	21·9
Bristol ..	189,648	4445	9	109	39	20	92	106	141	2·7	23·5
Wolverhampton ...	70,084	1788	2	3	124	7	29	83	95	4·9	25·5
Birmingham ...	355,540	9004	122	123	586	100	177	205	732	5·8	25·3
Leicester ...	102,694	2545	2	60	6	14	62	63	312	5·1	24·8
Nottingham ...	89,557	2107	—	33	11	—	25	70	130	3·0	23·5
Liverpool ...	505,274	13,301	10	348	215	5	166	314	911	4·0	26·3
Manchester ...	354,057	10,835	20	354	545	11	157	288	753	6·0	30·6
Salford ...	130,468	3884	4	236	127	8	49	88	278	6·1	29·8
Oldham ...	85,141	2235	1	8	120	1	20	41	105	3·5	26·3
Bradford ...	156,609	3921	21	11	47	3	112	128	197	3·3	25·0
Leeds ..	272,619	7643	112	48	628	22	109	210	500	6·0	28·0
Sheffield ..	254,352	6654	5	192	248	15	159	238	426	5·0	26·2
Hull ..	128,125	3101	26	40	36	7	43	122	227	3·9	24·2
Sunderland ...	102,450	2371	1	33	28	16	58	53	153	3·3	23·1
Newcastle-on-Tyne ..	133,246	4059	4	76	466	11	36	111	227	7·0	30·5
Total ..	6,485,894	158,503	503	3893	3874	608	4020	3830	9255	4·0	24·4
SCOTLAND.											
Glasgow ..	498,697	14,494	226	628	580	149	319	355	443	5·4	29·1
Edinburgh ...	208,322	4577	14	131	49	35	86	159	140	2·9	22·0
Dundee ...	128,250	3280	15	24	43	97	79	110	217	4·6	25·6
Aberdeen ...	91,626	2120	2	22	116	25	85	84	55	4·2	23·1
Total ...	926,895	24,471	257	805	788	306	569	708	855	4·6	26·4
IRELAND.											
Dublin ...	314,666	8212	16	66	233	38	250	274	206	3·4	26·1
Belfast ..	182,214	4761	14	165	44	9	97	171	185	3·7	26·1
Cork ..	90,851	2481	13	50	17	7	52	80	72	3·2	27·3
Total ...	587,731	15,454	43	281	294	54	399	525	463	3·5	26·3

From the foregoing table it may be seen that, although the death-rate from all causes in the principal towns of Ireland is higher than in England, and very little lower than in Scotland, still the death-rate from the seven zymotic diseases is much lower than in either England or Scotland. The following are five towns in which the rate of mortality from all causes is highest, contrasted with a similar number in which it is lowest :—

32 *Diseases which raised the Town Mortality.*

HIGHEST.	Rate per 1,000 Inhabitants.	LOWEST.	Rate per 1,000 Inhabitants.
Manchester ...	30·6	Portsmouth ...	18·6
Newcastle-on-Tyne...	30·5	Norwich ..	21·9
Salford ...	29·8	Edinburgh ..	22·0
Glasgow ...	29·1	London ...	22·8
Leeds ...	28·0	Aberdeen ...	23·1

Four of the five towns in which the death-rate from all causes is highest also appear in the following list of those in which the death-rate from the seven zymotic diseases specified is highest, as also do three of those in which the rate is lowest :—

HIGHEST.	Rate per 1,000 Inhabitants.	LOWEST.	Rate per 1,000 Inhabitants.
Newcastle-on-Tyne...	7·0	Norwich ..	2·2
Salford ...	6·1	Portsmouth ...	2·7
Manchester ...	6·0	Bristol ...	2·7
Leeds ...	6·0	Edinburgh ...	2·9
Birmingham ..	5·8	Nottingham ...	3·0

The particular diseases which raised the rate of mortality in the foregoing towns were as follows: Newcastle-on-Tyne, scarlatina; Salford, measles and diarrhœa; Leeds, scarlatina; and Birmingham, scarlatina and diarrhœa. The rates of mortality from scarlatina and measles are much higher in Scotland than in the other two countries; whilst diarrhœa affords the highest death-rate in England, and fever in Ireland. The death-rate from fever is higher in Ireland than in Scotland or England, and that from diarrhœa is higher in England than in either Scotland or Ireland. The number of deaths from diarrhœa in England is more than double that from any of the other six specified zymotic diseases.

The death-rates per 1,000 of the population in the foregoing large towns and for the country in general are here contrasted :—

COUNTRIES.	Death-rate per 1,000 of the Population in Large Towns.	Death-rate per 1,000 of the Population of the country in general.
England and Wales ...	24·4	21·2
Scotland ...	26·4	22·4
Ireland ...	26·3	18·3

In 1873 the birth-rate in England was in the ratio of 35·7 per 1,000 of the population; in Scotland 34·9 per 1,000; and in Ireland 27·1 per 1,000. I do not believe that the latter figure is at all accurate.

The vital statistics collected in Ireland in many cases are unreliable. Some years the birth-rate in Dublin was actually stated to be under the death-rate. Every physician in Dublin must know that in it the births greatly exceed the deaths, and that the discrepancy between the actual birth-rate and that recorded by the Registrar-General arises from the fact that the lower classes do not, whenever it is possible, cause the births of their children to be registered. I believe that a large percentage of the births of children born without their mothers having received medical assistance is not officially recorded in this city.

I should, however, remark that the registration of deaths and births appears to be becoming more complete, and in some parts of the country tolerably accurate.

The registration of births and deaths in Ireland requires amendment. The law making it compulsory to record those events should be rendered more stringent. No interment should be permitted unless the persons conducting the funeral produce to the keeper of the cemetery a medical certificate showing the cause of death. The police or the sanitary sub-officers might be employed in ascertaining recent births and deaths, and in serving cautionary notices to have those events registered. Their services in this way might be annually rewarded; the bonus being proportionate to the number of cases registered in consequence of their information.

The fee received by the medical registrar for recording a death is only one shilling—a remuneration absurdly small, and hardly adequate to pay for the mere scrivenery connected with the registration work. The sum paid for each registration should, at least, be doubled. It has frequently been suggested that it would be desirable to relieve the dispensary doctors from their functions as registrars of births and deaths. On this subject, and in reference to the desirability of appointing them to be health officers, I made the following observations in the year 1867:—¹

“To me it appears evident that no satisfactory results will flow from any system of registration that is not exclusively managed by medical men. The duty of recording the births and deaths—I will say nothing of the marriages—should be entrusted to the poor-law medical officers; who, in return for their monopoly of this function, should be obliged to perform their work in a manner that would ensure its results being valuable to statistical and sanitary science. To any one who appreciates the advantages derivable from the study of accurate vital statistics, the peculiar fitness of physicians for the office of registrars of births and deaths is obvious. They would not commit the mistakes in the nomenclature of disease which the non-medical registrars sometimes make,

¹ Lectures on the Preservation of Health, page 168.

thereby rendering their returns worse than useless. They alone would be able to indicate the causes of an unusual amount of mortality in their districts. As they constitute more than a third of the whole body of medical practitioners, and undoubtedly have charge of more than two-thirds of the sick, they have themselves the opportunity of ascertaining, personally, a large, if not the largest, proportion of the deaths occurring in their districts.

"I am quite satisfied that it is in the power of the dispensary physicians who are also the registrars of deaths and births to enlarge our knowledge of the etiology of disease—the first step towards its prevention or cure. We have a great deal to learn, not only relative to the ills which flesh is heir to, but to the flesh itself. Why is it that a disease extinguishes the spark of life in one man, deals gently with another, and passes by a third? I believe that the causes of death are seldom simple, and that in the majority of cases it is a bad constitution (*diathesis*), and not his malady, that kills the sick man. No doubt, it is useful to learn how many members of the community die annually from consumption; but the information would be far more valuable if it were known in how many cases the disease was the result of following an injurious trade, or of living upon a damp soil—whether it was produced from a direct cause, or was the result, mediate or immediate, of a constitutional tendency to phthisis. In short, the object for which vital statistics are collected would be more likely to be achieved if accurate information were obtained relative to the causes, proximate and remote, of deaths. It might be found practicable to fill up some such form as that shown in the diagram.

"Particulars to be stated in Form for Registration of Death.

"Name—Age—Bachelor—Married or Widower—Birth-place—Diathesis—Occupation—Climatic and Telluric Conditions of Residence and Place of Business—Ages at, and Diseases of, which his relatives of the first degree had died—Disease or Diseases which directly or indirectly caused the death.

"It is, of course, not to be expected that so comprehensive a form as this is would, in the majority of cases, be filled up satisfactorily; but I am confident that the adoption of some such form of death registration would be the means of accumulating a mass of valuable medical statistics for the purposes of public hygiene."

VITAL STATISTICS OF DUBLIN FOR 1873.

The population of the Dublin Registration District was in 1871 314,660; and has probably remained stationary since.

BIRTHS.—During the year 1873 there were *registered* in the Dublin Registration District, 9,032 births—4,580 boys and 4,452 girls—being equal to a ratio of 1 in 35, or 29 per 1,000 of the population.

Of these 9,032 births, 3,589, or 33 in every 1,000 of the population, occurred in northern districts of the city; and in the southern the number was 3,837, or 28 per 1,000 of the population. In the suburban districts of Rathmines, Donnybrook, Blackrock, and Kingstown the number of births amounted to 1,606, or 24 in every 1,000 of the population.

2,341 births were registered during the first quarter, 2,372 in the second, 2,181 in the third, and 2,138 in the fourth, the weekly average being 170.

In London the number of births registered during the year 1873 was 121,098, being equal to a rate of 36 in every 1,000 of the estimated population; in Glasgow the number was 19,801, equal to 40 per 1,000; and in Edinburgh it was 6,917, affording a birth-rate of 33 per 1,000 of the estimated population.

The registration of births is very imperfectly carried out in Ireland, as I have already repeatedly stated. It is absurd to believe that the births in Dublin, or any part of Ireland, but slightly exceed the deaths. The prolificness of the Irish has become almost a proverb.

DEATHS.—8,212 deaths were registered in the Dublin Registration District during the year 1873—4,121 males and 4,091 females—being equal to a ratio of 1 in 38, or 26 in every 1,000 of the population.

In north Dublin there were registered 2,947 deaths, or 27 in every 1,000 of the population, and in south Dublin side 3,992, or 29 per 1,000 of the population. In the suburban districts of Rathmines, Donnybrook, Blackrock, and Kingstown, deaths registered numbered 1,273, or 19 in every 1,000 of the population, the ratio being respectively, Rathmines, 17; Donnybrook (which includes the City of Dublin Hospital and the Hospital for Incurables), 24; Blackrock, 17; and Kingstown, 15 in every 1,000 of the population.

2,602 deaths were registered in the first quarter, 1,941 in the second, 1,639 in the third, and 2,030 in the fourth, the weekly average being 155.

Of the 8,212 deaths, 1,161 occurred in hospitals, prisons, and lunatic asylums; 532 in the North Dublin Union Workhouse, and 821 in the South Dublin Union Workhouse; a total of 2,514, or 31 per cent. of the total deaths registered.

DISEASES.—The number of deaths from zymotic diseases registered during the year was only 1,378, or 16·8 per cent. of the total deaths, or in the ratio of 4·4 in every 1,000 of the population. The average yearly number of deaths from these diseases registered during the previous nine years was 1,906, or 23·3 per cent. of the average annual mortality from all causes, and equal to 6·1 in every 1,000 of the population.

Sixteen deaths were caused by small-pox, 233 by scarlet fever, 250 by whooping cough, and measles 66 against 202 in 1872. "The returns for the last ten years show that in any year in which the mortality in Dublin from one of these diseases is large the deaths from the other are comparatively few, and that, generally speaking, they succeed one another in alternate order—one or other of them being prevalent to a considerable extent every year."

The various forms of fever caused 274 deaths, 53 by typhus, 16 by cerebro-spinal fever, 151 by typhoid or enteric, and 54 by simple continued fever, or "fever." The average annual number of deaths from fever for the nine years, 1864-72, was 390.

206 deaths were caused by diarrhoea, 38 deaths by diphtheria, 109 by croup, 20 by erysipelas, and 14 by quinsy.

The deaths from "constitutional" diseases amounted to 1,665, or 20 per cent. of the total deaths. Phthisis caused 1,050 deaths, or 12 per cent. of the total; bronchitis, 1,223 deaths, or 15 per cent. of the total; pneumonia or inflammation of the lungs, 185; apoplexy, 98; paralysis, 184; cephalitis mortalis or inflammation of the brain, 74; epilepsy, 44.

Convulsions proved fatal to 536 children.

Disease of the heart and circulatory organs killed 443, 19 from aneurism; liver disease, 146; jaundice, 9; inflammation of the liver, 7; spleen disease, 3; Bright's disease, 52; inflammation of the bladder, 8; inflammation of the kidneys, 7; diabetes, 5; unspecified kidney disease, 72.

Dublin Mortality Tables.

There were recorded 189 deaths from accident or negligence—including 70 from fractures and contusions, 42 from burns or scalds, 52 from drowning, and 4 from poison—16 cases of homicide and 11 of suicide were registered during the year. "The table shows, by diseases and quarterly periods, the deaths registered in the Dublin Registration District in 1873; the deaths from each disease registered in 1864-72 respectively; and the number of deaths from each disease to every 100 deaths from all causes in 1873:—

Name of Diseases.		Total Number of Deaths Registered.										Number of Deaths from each Disease to every 100 Deaths from all causes in 1873.
		1873 *53 weeks	1872 52 weeks	1871 52 weeks	1870 52 weeks	1869 52 weeks	1868 *53 weeks	1867 52 weeks	1866 52 weeks	1865 52 weeks	1864 52 weeks	
Zymotic Diseases.												
Small-pox	...	16	1,350	207	..	1	1	2	25	71	42	0·20
Measles...	...	66	202	26	53	159	49	465	54	164	12	0·80
Scarlatina	...	233	178	253	448	510	424	259	109	100	126	2·84
Diphtheria	...	38	26	22	22	18	20	19	35	28	40	0·46
Whooping Cough	..	250	66	212	136	21	250	178	194	126	82	3·04
Fever ..	..	274	321	398	371	286	313	359	537	526	395	3·34
Dysentery	..	6	12	19	19	23	26	17	33	45	45	0·07
Diarrhoea	...	206	196	252	320	248	408	320	313	314	205	2·51
Cholera ..	...	5	5	12	13	6	12	38	1,186	17	4	0·06
Other Zymotic Diseases	..	284	266	319	297	285	359	312	345	308	327	3·46
Total	...	1,378	2,622	1,720	1,679	1,556	1,862	1,909	2,831	1,699	1,278	16·78
Constitutional Diseases.												
Phthisis or Pulmonary Consumption ..	...	1,050	1,086	977	974	957	957	1,049	984	1,062	97	12·79
Other Constitutional Diseases ..	...	615	670	650	644	647	733	805	680	839	727	7·49
Total	..	1,665	1,756	1,627	1,618	1,604	1,690	1,854	1,664	1,901	1,634	20·28
Local Diseases.												
Diseases of the	Brain and Nervous System	1,093	1,074	1,046	1,021	978	1,138	1,209	1,122	1,093	1,070	13·31
	Heart and Circulatory Organs	443	353	344	367	383	375	377	372	369	326	5·39
	Respiratory Organs	1,605	1,366	1,546	1,287	1,508	1,302	1,664	1,388	1,534	1,507	19·55
	Digestive Organs	305	263	317	311	335	271	291	322	309	350	3·71
	Urinary Organs	147	124	126	93	120	98	100	142	110	106	1·79
	Organs of Generation	22	10	19	18	13	18	26	23	21	22	0·27
	Organs of Locomotion	17	15	26	21	20	17	19	16	23	14	0·21
	Integumentary System	14	8	7	8	10	11	9	7	8	23	0·17
Total	..	3,646	3,213	3,431	3,226	3,367	3,230	3,695	3,392	3,467	3,318	44·40
Developmental Diseases	..	1,091	1,022	1,032	861	853	931	869	846	831	752	13·29
Violent Deaths	..	224	222	183	215	194	196	194	194	165	180	2·72
Causes not specified or ill-defined	...	208	138	151	126	101	95	86	107	88	183	2·53
General Total	..	8,212	8,973	8,144	7,728	7,675	8,004	8,607	9,034	8,151	7,345	100·00
Mean Temperature of the Air												
		48·8	49·5	49·4	49·0	49·8	50·8	49·0	49·2	50·3	48·9	...
Rainfall in inches												
		26·74	35·81	28·25	†	28·02	24·10	24·05	26·86	28·23	25·49	..

† The rain-gauge was out of order for part of December, 1870.

Ages at, and Periods of, Death.

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Ages and quarterly periods of the deaths registered in the Dublin Registration District during the years 1864-73, respectively, together with a proportion per cent. of deaths at each age-period:

Periods.		Deaths of Persons of the Ages —							Ages unspecified.	Total Deaths.
		Under 5 years.	5 and under 15.	15 and under 20.	20 and under 40.	40 and under 60.	60 and under 80.	80 and upwards		
1st Quarter ...	1864	577	132	38	370	437	567	133	6	2,260
	1865	655	134	64	426	542	588	110	5	2,524
	1866	676	112	62	346	534	532	114	7	2,423
	1867	685	148	66	492	596	648	115	2	2,752
	1868	793	188	63	373	421	447	78	5	2,378
	1869	579	176	51	407	441	557	106	6	2,323
	1870	593	143	54	366	493	529	107	3	2,288
	1871	870	148	59	463	461	556	109	4	2,575
	1872	710	223	162	620	474	532	104	1	2,826
1873	641	132	65	413	508	709	134	..	2,602	
2nd Quarter ...	1864	483	111	48	339	317	350	65	7	1,720
	1865	543	104	60	371	389	340	64	3	1,874
	1866	543	150	71	356	408	426	84	16	2,054
	1867	725	194	61	351	366	405	69	2	2,173
	1868	471	151	58	341	371	372	62	1	1,827
	1869	472	152	54	290	380	382	81	5	1,814
	1870	482	127	59	341	367	370	67	3	1,816
	1871	510	142	67	381	341	370	66	3	1,880
	1872	659	263	125	535	429	416	77	1	2,505
1873	533	134	55	331	408	400	77	3	1,941	
3rd Quarter ..	1864	528	98	46	235	277	272	58	3	1,517
	1865	710	108	55	263	284	256	55	3	1,734
	1866	506	166	63	361	409	327	53	6	1,891
	1867	722	150	42	284	273	271	68	...	1,810
	1868	775	96	46	256	321	316	52	7	1,869
	1869	625	138	50	276	269	268	46	1	1,673
	1870	638	103	43	279	262	278	50	1	1,654
	1871	499	92	57	287	254	289	43	4	1,525
	1872	597	144	65	328	291	299	58	2	1,734
1873	551	108	55	296	272	309	46	2	1,639	
4th Quarter ..	1864	583	106	47	307	347	382	71	5	1,848
	1865	655	119	39	334	389	385	95	3	2,019
	1866	681	277	74	551	558	438	84	3	2,666
	1867	668	149	43	279	322	348	61	2	1,872
	1868*	609	164	50	304	351	376	74	2	1,930
	1869	644	148	46	272	325	354	70	4	1,863
	1870	654	168	43	315	351	357	82	...	1,970
	1871	632	171	58	434	377	400	86	6	2,164
	1872	583	94	42	336	323	387	86	2	1,858
	1873*	656	149	53	297	349	440	81	...	2,030
Total ...	1864	2,171	447	179	1,251	1,378	1,571	327	21	7,345
	1865	2,563	465	218	1,394	1,604	1,569	324	14	8,151
	1866	2,406	705	270	1,654	1,909	1,723	335	32	9,034
	1867	2,800	641	212	1,406	1,557	1,672	313	6	8,607
	1868*	2,648	599	217	1,274	1,474	1,511	266	15	8,004
	1869	2,320	614	201	1,245	1,415	1,561	303	16	7,675
	1870	2,367	541	199	1,301	1,473	1,534	306	7	7,728
	1871	2,511	553	241	1,470	1,433	1,615	304	17	8,144
	1872	2,549	724	394	1,819	1,522	1,734	325	6	8,973
1873*	2,381	523	233	1,337	1,537	1,858	338	5	8,212	
Per-centage of Total Deaths at each Age Period	1864	29.5	6.1	2.4	17.0	18.8	21.4	4.5	0.3	100.
	1865	31.4	5.7	2.7	17.1	19.7	19.2	4.0	0.2	100.
	1866	26.6	7.8	3.0	18.3	21.1	12.1	3.7	0.4	100.
	1867	32.5	7.4	2.5	16.3	18.1	19.5	3.6	0.1	100.
	1868	33.1	7.5	2.7	15.9	18.4	18.9	3.3	0.2	100.
	1869	30.2	8.0	2.6	16.2	18.4	20.4	4.0	0.2	100.
	1870	30.6	7.0	2.6	16.8	19.1	19.9	3.9	0.1	100.
	1871	30.8	6.8	3.0	18.1	17.6	19.8	3.7	0.2	100.
	1872	28.4	8.1	4.4	20.3	16.9	18.2	3.6	0.1	100.
1873*	29.0	6.4	2.8	16.3	18.7	22.6	4.1	0.1	100.	

* The numbers given for 4th Quarter, 1873, and for 1873, embrace returns for 14 weeks and 53 weeks respectively, an arrangement occasionally necessary so that the annual series may correspond with the calendar year.

The death-rate in Dublin is high, but there are certain factors affecting it which are not taken into account in comparing Dublin mortality with that of other cities. 31 per cent. of the deaths registered occurred in hospitals, poor-houses, and lunatic asylums. Now, a large number of the persons who died in these institutions had lived in the South and North Dublin Unions—districts which stretch for miles into the open country. If these persons had died where they usually had resided their deaths would have seriously increased the mortality of the rural districts, and diminished that of the city. The mortality of the North Dublin district in 1873 was 27 in every 1,000 of the people. The population of this district is 108,676, but that of the whole Poor Law Union, of which North Dublin forms a part, is 134,091. In the rural districts inhabited by 25,415 souls, there are no hospitals or work-houses, and therefore the deaths amongst the rural population which occur in public institutions are all within the North Dublin City district, and serve to swell, but only apparently, the civic death-rate. In London, with the mortality of which it is usual to compare that of Dublin, the union districts are nearly coterminous with the registrar's areas. The stated death-rate of that city is its real one.

FOREIGN VITAL STATISTICS.

In the valuable report of the Board of Health of New York for the year ended April 30th, 1873, the population and death-rates of a large number of cities are given, from which the following statistics are extracted:—

DEATH-RATES IN CITIES DURING THE YEAR 1872.

CITIES IN AMERICA.

CITY.	Population.	Deaths in 1872.	Death-rate per 1,000 Inhabitants.	CITY.	Population.	Deaths in 1872.	Death-rate per 1,000 Inhabitants.
New York	1,000,000*	32,647	32.6	Charlestown	28,330	769	27.1
Philadelphia	728,000*	18,987	26.1	Savannah	28,235	1,108	39.2
Brooklyn	450,000*	12,648	28.1	Elizabeth	27,000*	371	13.7
St. Louis	400,000*	8,047	20.1	Peoria	26,000*	429	16.5
Chicago	367,293	10,156	27.6	Salem	26,000*	6.2	23.1
Baltimore	300,000	7,546	25.1	New Bedford	23,000*	521	22.6
Boston	265,000*	8,089	30.5	Hoboken	22,000*	723	32.9
Cincinnati	250,000*	5,116	20.5	Chelsea	21,000*	384	18.3
New Orleans	200,000*	6,122	30.6	Galveston	20,000*	559	27.9
San Francisco	188,321	3,232	17.2	Petersburg	20,000*	539	26.9
Buffalo	150,000*	2,594	17.3	Terre Haute	20,000*	365	18.2
Cleveland	120,000*	2,337	19.5	Wilmington	18,000*	430	23.9
Newark	115,000*	3,436	31.6	Sacramento	16,298	352	21.6
Washington	110,000*	2,230	2.3	Burlington	16,060*	157	9.8
Detroit	100,000*	2,390	23.9	Gloucester	16,000*	351	21.9
Albany	95,000*	1,877	19.7	Denver	16,000*	135	8.4
Milwaukee	90,000	1,961	21.8	Vicksburg	15,000*	548	36.5
Pittsburg	86,076	2,353	27.3	Jacksonville	10,000*	134	13.4
Providence	72,910	1,610	22.1	Montreal	121,000*	4,512	37.3
Rochester	65,421*	1,188	18.3	St. John	46,000*	651	14.1
Richmond	60,000*	1,714	28.6	Halifax	31,000*	961	31.0
Memphis	55,000*	2,561	46.6	Havana	20,000*	7,031	35.1
New Haven	55,000*	1,215	22.1	Valparaiso	100,000*	6,695	66.9
Lynn	30,600	598	19.9				

* In the cities marked with a star, the population is estimated; in others, actual.

CITIES IN EUROPE.

Paris	1,851,792	39,111	21.1	Turin	212,644	6,476	30.4
Lyons	323,417	8,645	26.7	Milan	199,009	6,897	34.6
Bordeaux	194,000	4,648	23.9	Florence	167,96	5,953	35.6
Havre	86,325	2,712	31.4	Genoa	130,269	4,139	31.8
Nice	52,377	1,670	31.8	Venice	128,901	3,915	30.4
Berlin	828,00*	26,76	32.3	Bologna	115,957	3,999	34.5
Hamburg	338,974	9,49	26.7	Messina	111,854	2,710	24.1
Munich	169,478	7,77	41.8	Leghorn	97,006	2,971	3.6
Leipsic	110,000*	2,553	23.2	Amsterdam	277,766	7,477	26.9
Dresden	177,055	5,239	29.6	Rotterdam	122,471	3,818	31.1
Stuttgart	96,000*	2,226	23.2	The Hague	91,785	2,263	24.4
Frankfort-on-the-Maine	92,000*	1,955	21.2	Copenhagen	190,000*	4,487	23.6
Bremen	85,00*	2,142	25.2	Brussels	185,000*	4,176	22.6
Mayence	47,821	1,399	29.1	Antwerp	143,545	3,751	26.1
Vienna	644,356	20,506	31.8	Stockholm	140,000*	4,461	31.8
Trieste	125,648	6,788	46.0	Christiana	70,00*	1,453	20.7
Prague	162,000*	7,932	48.9	Cadiz	51,732	2,445	44.7
Naples	448,335	15,996	35.7	Athens	49,000*	1,621	33.0
Rome	244,484	9,924	40.6	Geneva	47,581	923	19.4
Palermo	219,398	5,493	25.0	Basle	46,554	975	20.9
				Zurich	21,199	294	13.9

DEATH-RATE AFFECTED BY BIRTH-RATE.

Mr. Watt, of Montreal, endeavours to prove what he terms the fallacies of the Registrar-General's conclusions with respect to the mortality tables of towns. He states that the mere death-rate of a place is no criterion as to its salubrity, unless corrected by means of factors taken from the birth-rate. The immigration into or the emigration out of a town also affect the conclusions deducible from the mortality tables. Dr. Letheby agrees with Mr. Watt. He states—

“In the weekly and quarterly returns of the Registrar-General, the death-rates of certain British and continental towns and cities are so prominently stated that the reader is apt to conclude they are the direct expressions of their sanitary condition. But nothing can be more fallacious; for the town with the lowest death-rate may be the most unhealthy, and so also conversely. To take, for example, the list of places referred to by the Registrar-General in his quarterly report, it would seem that Dublin, with a death-rate of 22.72 per 1,000 of the population, must be considerably more healthy than Liverpool with a mortality of 27.29 per 1,000. In reality, however, it is the reverse; for, if measured by the birth-rate as well as the death-rate, it will be found that Liverpool is in a better sanitary condition than Dublin. Taking, in fact, the average birth-rate (35.08 per 1,000) and the death-rate (22.58 per 1,000) of England as the standards for comparison, it will be seen that the actual death-rates of these places during the year which has just expired are very different from the calculated death-rates; and that little or no estimate can be made of the comparative salubrity of these places by mere reference to the observed death-rates.

* In the cities marked with a star the population is estimated; in others, actual.

OBSERVED ANNUAL BIRTH-RATE AND DEATH-RATE PER 1,000 OF THE
POPULATION, AND THE CALCULATED DEATH-RATE.

	ANNUAL RATE PER 1,000 LIVING.			
	Births.	Deaths.	Calculated Death- rate.	Difference of actual Deaths.
Birmingham	35·65	20·35	22·94	-- 2·59
Bristol	36·09	22·64	23·23	-- 0·59
Leeds	40·86	27·26	26·30	+ 0·96
Sheffield	36·83	25·94	24·86	+ 1·08
Newcastle-on-Tyne ...	38·88	26·27	25·02	+ 1·25
London	35·48	24·13	22·83	+ 1·30
Bradford	37·94	26·03	24·44	+ 1·59
Salford	39·47	27·67	25·41	+ 2·26
Liverpool	36·93	29·07	23·77	+ 5·30
Manchester	35·91	29·15	23·11	+ 6·04
Edinburgh	37·64	30·63	24·23	+ 6·40
Berlin	41·78	33·61	26·89	+ 6·72
Dublin	25·93	23·81	16·69	+ 7·12
Glasgow	40·11	34·23	25·82	+ 8·41
England (average) ...	35·08	22·58	22·58	0·00
Austria	40·45	30·85	26·63	+ 4·42
France	26·68	23·27	17·17	+ 6·11

It is but fair to state, that in the full reports published by the Registrar-General he points out that fallacious conclusions might be drawn from his statistics; and he explains the necessary corrections which must be made in comparing the mortality returns of towns with those of the rural districts. In the weekly returns published in the newspapers these corrections are not, however, given; and consequently the inhabitants of very unhealthy towns, the observed death-rate of which may happen to be low, conclude from the Registrar-General's returns that their sanitary state is excellent.

REGISTRATION OF DISEASE AND DEATH.

Sanitarians generally attach great importance to the periodical publication of the status of disease. It has been suggested that the usual weekly returns of illness made out by the ordinary poor-law medical officers should be applied in such a way as would render them available for national, instead of purely local purposes. Each dispensary physician makes a weekly return to his board of guardians; a copy of this return might be forwarded to a central office—for example, to the office of the Registrar-General—where

the facts contained in it, and other similar returns, would be classified, and published with reports upon them, conveying valuable information to the local health authorities and to the general public.

If a system of disease registration were initiated by the poor-law authorities, statistics of disease would very soon follow from hospitals, infirmaries, asylums, private dispensaries, medical relief associations, and from other sources: even private practitioners might ultimately be induced to co-operate in securing a really general national system of disease registration, which would be invaluable as a means of investigating the etiology of the zymotics, and perhaps of other maladies.

In the second report (vol. iii.) of the Royal Sanitary Commission, we learn that the Commission heard evidence relative to death registration in Ireland. Dr. W. M. Burke, the medical superintendent of statistics, gave very strong testimony against the present system of registration, which, especially in the country districts, was "very imperfect." Dr. Burke stated that the form of death register (which is prescribed in the act applicable to Ireland) is objected to by medical men, because in signing it they testify to the actual death, which in most cases they do not witness, or of which they have no ocular proof. The certificate to be signed by the medical attendant should merely state the maladies under which the deceased laboured when last seen by the medical attendant. Dr. Burke stated that medical men "very often" refuse to sign death certificates. In reply to a question put to him, he said "medical men object more to the wording of the certificate than anything else. I think I can illustrate this by a circumstance which occurred in Dublin: I cannot fix the date of the occurrence, but it is not very long since. A physician, in large practice in Dublin, was told that a patient of his was dead. The physician, on being informed of his death, went up to the patient's room and found him alive. The certificate goes on to say, 'I hereby certify that I attended' so-and-so; 'who was apparently aged, or was stated to be aged,' so many years. 'That I last saw him on' such a date, 'and that he died on a certain day; that the cause of his death was' so-and-so; 'and that the disease had continued for' a certain period. The physicians and surgeons of Ireland object to be asked to furnish all those details, and to furnish them gratuitously. In the majority of cases they say that they may not have been present when the patient died; and all the evidence they have of the patient's death is the information which they receive from some of the family, or other persons. They are, generally speaking, willing and anxious to certify as to the cause of death, but they object to be informants of the death."

One—and the chief—cause of the defect in the registration of births and deaths in Ireland is the negligence of the people. There should be a heavy penalty imposed upon those whose duty it is to register those events. Dr. Burke said that the services of the police could be rendered available in ascertaining the occurrence

of births and deaths. These events could hardly take place in the rural districts without coming to the knowledge of the police, if the latter had a special reason for acquiring such information. The special reason should be a *douceur* in the shape of a small coin. I believe that if the services of the police were enlisted in this matter, the registration of vital statistics in Ireland would, so far as ascertaining the number of births and deaths is concerned, soon approach perfection.

It is evident that the birth-rate amongst a population cannot be actually determined if the still-born children are not taken into account. The births of still-born children are not registered in Ireland; and Dr. Burke stated that it would be impracticable to do so: it would, however, be most desirable to make their registration compulsory, for in such case a large proportion of them would be recorded in the registrars' lists.

Dr. Burke is of opinion that practitioners would not, and should not, afford information relative to the diseases from which their private patients suffered. He thinks the statistics of disease could be sufficiently collected from hospitals, dispensaries, work-houses, lunatic asylums, jails, and public institutions. The statistics obtained from these sources would, according to Dr. Burke, give a fair account of disease generally in the country. As practitioners constantly publish cases of disease occurring amongst their private patients, suppressing, of course, their names, they might probably see no impropriety in furnishing to the registrars periodically *confidential* statements (omitting names), showing the number of cases of particular disease which they had treated during a particular time, and within certain areas.

Sir Dominic Corrigan condemns the form of death certificate at present in use; and he states that he refused to sign death certificates; for only once during the last eight years which have occurred since the passing of the Registration Act was he able to testify from actual personal knowledge to the time at which the death of a patient occurred.

"Let," says Sir Dominic, "the Legislature mend its ways and correct the present defective state of the law, without expecting the medical profession to sacrifice truth and self-respect to prop blundering Acts of Parliament.

"I hope this state of things will soon be amended. A revised code of sanitary laws is almost now under consideration, and I trust our legislators will learn that, in framing such laws, they should seek for assistance from those bodies that understand the subject."

The Irish Census Commissioners, in their report for 1851, included in their Social Survey an inquiry as to the health of the people, and, by means of forms constructed for the purpose, ascertained not only the number of the sick in hospitals, workhouses, and sanitary institutions, but also the number of persons labouring under sickness in their own homes, together with the

description of the disease under which they suffered. Similar inquiries were made by the Commissioners of 1861 and 1871, and the following are the general results afforded by each:—On the night of the 30th March, 1851, the number of persons labouring under permanent or temporary diseases in Ireland was found to be 104,495, or 1,595 in every 100,000 of the population. On the night of the 7th of April, 1861, the number was 76,008, or 1,311 in a like number of the population; and on the night of the 2nd of April, 1871, the number returned was but 71,612, or 1,324 in every 100,000 persons. It must, however, be borne in mind that these numbers include persons afflicted with permanent diseases, such as deaf-dumbness, blindness, &c.

The following table shows the number of persons returned on the three occasions as suffering from zymotic diseases:—

Diseases.	Number Suffering from each Disease.			Number in every 100,000 of the Population.		
	1851.	1861.	1871.	1851.	1861.	1871.
Small-pox ..	888	116	122	13·6	2·0	2·3
Measles ..	1,035	1,308	274	15·8	22·5	5·1
Scarlatina ..	324	266	477	4·9	4·5	8·8
Dysentery ..	6,716	480	105	102·5	8·2	1·9
Diarrhœa ..	3,013	659	362	45·9	11·3	6·7
Influenza ..	3,542	2,330	202	54·0	40·1	3·7
Fever ..	13,777	2,350	2,070	210·3	40·5	38·3
Ophthalmia ..	3,883	1,307	603	59·3	22·5	11·1
Other Zymotic or Epidemic, } Endemic, and Contagious Dis- } eases }	1,820	1,006	1,063	27·8	17·3	19·6
Total ..	34,998	9,822	5,278	534·1	169·3	97·5

From the foregoing table it will be observed that in 1851 as many as 534 in every 100,000 of the population were suffering from zymotic or epidemic diseases; that in 1861 the proportionate number was 169; and that in 1871 it was but 97. The disease in this class most prevalent on each occasion was fever, from which as many as 13,777 were suffering on the census night in 1851; 2,350 in 1861; and but 2,070 in 1871. It may, therefore, be inferred from these comparisons that the state of public health in Ireland was favourable in 1871.

If the number suffering from permanent diseases, such as deaf-dumbness, blindness, insanity, idiocy, &c., were excluded from the total of sick returned in 1871, there would be a balance of 42,390 persons labouring under diseases which are for the most part temporary. The daily average of deaths registered during the months of April, May, and June, 1871—the quarter which includes the census day—amounts to 246·6, so that the rate of mortality to sickness would be as 1 to every 171·9. The number of the sick,

however, includes many suffering from diseases which do not prove fatal, and which tend materially to make this ratio so low.

In reference to the permanently diseased, it may be interesting to know the number of the deaf and dumb, blind, idiotic, and lunatic persons in the United Kingdom at the time of taking the census of 1871, and I, therefore, insert the following table, from which it may be learned that in Ireland the ratio of the two first classes of afflicted persons to the population is much higher, and that of the idiotic lower, than in either England or Scotland, whilst the ratio of the insane to the population is higher than in England and lower than in Scotland.

Table showing the number of the Deaf and Dumb, Blind, Idiotic, and Lunatic in the United Kingdom in 1871.

Disease.	England and Wales.		Scotland.		Ireland.		United Kingdom.			
	Number.	Ratio to Population.	Number.	Ratio to Population.	Number.	Ratio to Population.	Number.			Ratio to Population.
							Males.	Females.	Total.	
Deaf and Dumb }	11518	1 in 1972	2087	1 in 1610	5554	1 in 974	10489	8670	19159	1 in 1643
Blind ...	21590	„ 1052	3019	„ 1113	6347	„ 852	15890	15066	30956	„ 1017
Idiotic ...	29452	„ 771	4621	„ 727	6742	„ 802	20778	20037	40815	„ 771
Lunatic ...	39567	„ 574	6792	„ 495	9763	„ 554	26235	29887	56122	„ 561

CHAPTER V.

WATER SUPPLIES.

WITHIN the last twenty years great attention has been given to the subject of the water supplies of towns, and the chemical examination of water from private wells has of late become very general. During the middle ages almost every European town was supplied with water derived from superficial wells situated within the urban limits. At the present time, although an elaborate system of sewerage works conveys the waste matters of towns into rivers or the ocean, the water of town wells and pumps is often, nay generally, loaded with dangerous organic matter. We may therefore easily imagine how impure must have been the water obtained from town wells in mediæval ages, when the soil was saturated with those waste animal and vegetable matters which in modern times are haply, for the most part, got rid of by subter-

anean conduits. In former ages the mortality of towns was frightfully in excess of that of country districts. In many instances the death-rate of a crowded city was more than double that of rural districts situated under the same climatic conditions. Narrow streets, overcrowded and ill-ventilated tenements, defective provision for the removal of effete matters, and personal uncleanness were prime causes of the shortness of human life in mediæval times, indeed, in towns long after that gloomy period of European history had passed away. But a prime factor in the causes of the unhealthiness of towns was the bad water which their wells supplied. When fearful epidemics decimated the inhabitants of cities the cry often arose that the wells were poisoned. This complaint was in general only too true; but the poison in the wells was not put into them designedly—it was derived from the foul drainage of the soil, tainted with the matters thrown out from the bodies of the sick. In former times one of the most active agents in spreading epidemic diseases amongst crowded centres of population was impure potable water.

During recent years matters with respect to supplies of water for domestic purposes in town and country appear to be very much reversed. Formerly the citizen, as a rule, was obliged to drink water of a bad or doubtful quality, whilst the denizen of country parts could easily get his draughts of the pure element from crystal spring or sparkling rivulet. Now, the inhabitants of the larger towns are gradually giving up the use of pump water, and are substituting therefor pure water obtained from distant lakes and rivers. On the other hand, owing to various causes, the water used for domestic purposes in the country is not, in general, as pure as it was in the middle ages. In the first place, the rural population has increased, and there is, consequently, more effete animal matter thrown into the soil. Secondly, tillage husbandry, which includes the application of large quantities of manure to the land, has been largely extended. It may be that the potable water in use in country districts is not greatly inferior to that used in the middle ages; but that there is some deterioration in its quality is certain; and this fact is evident, that most of the large towns are now supplied with better water than is usually obtainable in villages and in a large proportion of detached country houses.

The ocean is the indirect source of all the water of our rivers and springs. The heat of the sun's rays is continuously distilling the water from the ocean's surface, and converting it into invisible vapour, or gas. The air holds this vapour, or steam, in solution, somewhat in the same way that sugar is dissolved in water, and the warmer the air is, the greater is the quantity of water vapour which it is capable of holding in solution. There are continued currents in the atmosphere, and the air which to-day overlies the ocean may to-morrow be a hundred miles from the sea. When the temperature of air saturated with watery vapour becomes lowered, then its capacity for holding water in solution being dimi-

nished, a portion of that substance is condensed and assumes some liquid or solid form, such as rain, snow, ice, or dew. Mountain tops cool the air, and hence much of the rain that falls descends on the uplands. Of the water derived from this atmospheric source, a small proportion evaporates into the air, and the remainder gradually drains into the ocean, from which, in the progress of time, it will be again converted into vapour. On its way to the sea it gathers itself together—so to speak—and forms rivers. The smallest springs and the largest rivers are produced from drainage water; and wells made by digging deep into the earth intercept a portion of the underground drainage water ere it reaches a river.

Our water supplies being directly derived from drainage, it follows that the nature of the rock or soil from which this indispensable fluid is collected exercises some influence upon its composition. In soils there are a great many substances which water is capable of dissolving. The water in the soil usually contains carbonic acid gas, whereby it is enabled to dissolve chalk and other substances which are insoluble in pure water. Most of these substances are used as food by plants; and although they are so soluble in water *out* of the soil, there is a beautiful provision of Nature which prevents the drainage water from removing them, except in small quantities, from the soil; for otherwise the most fertile land would speedily be deprived of its plant-food and be rendered barren. Drainage water, however, always contains some solid matters dissolved in it, and their amount chiefly depends upon the nature of the rocks which form the drainage area, or *catchment* basin, as the district yielding the water is termed. The *Plutonic*, or igneous rocks—granite, syenite, trap, porphyry, &c.—afford, with few exceptions, very pure water. The millstone grit yields also very good water, but generally somewhat harder than that obtained from granite and gneiss. In general, the lias (certain mixtures of clays and limestones), limestone, and chalk yield water not equal in purity to that obtained from the granitic rocks, but having a much pleasanter flavour, owing to the large quantity of carbonic acid gas which it holds in solution. This water is usually very hard. The water from dolomite, or magnesian limestone, and rocks containing gypsum resembles the chalk water, but it is not nearly so wholesome, owing to the bad effects which the sulphate of lime (gypsum, or plaster of Paris) produces on the stomach and other organs. The water from sandstones and rich soils under cultivation is generally impure. Surface drainage and subsoil water are occasionally good enough to be used for domestic purposes, but, as a rule, they are to be regarded with suspicion. Marsh water and water contaminated with sewage are extremely dangerous, and should never be used. The well water derived from the drainage of the surface of the ground is not so pure, as a general rule, as that obtained by sinking deep into the earth. The composition of shallow wells constantly varies, whilst that of very deep wells, and especially of the kind termed “artesian,” is nearly constant.

The drainage of the ground is affected not merely by the geological character of the rocks through which it flows, but also by the density of the population, the state of the water shed, and the provisions for the removal of organic refuse. In every place where a dense population exists, it is almost physically impossible that the surface water which supplies the superficial wells could be pure. In country districts this kind of water is occasionally very pure, owing to the absence of manure, or because the drainage is obtainable from a thin and grass-covered soil. The deeper the well is the greater is the drainage area which supplies it. A shallow well often collects only the drainage of a few hundred square yards; in which case the liquid, not having been subjected to prolonged contact with the purifying clay, is almost certain to contain organic impurities in excess. When making a well these points should be fully considered. If the well be only six or eight feet deep, care must be taken not to have a cesspool or manure heap on any part of the catchment area, for otherwise some oozeings from the manure would be sure to get into the well. For this reason, if for no other, liquid manure tanks and cesspools should be so constructed as to prevent the leakage of their contents. They should also be placed as far as possible from the well—an observation which applies with equal force to sewers.

A large proportion of the cases of well-water pollution which comes under my notice arises from leakages from sewers.

Lake water in these countries is usually very pure; in some of the Welsh lakes I have found little more than 0.001 per cent. of solid matters held in solution. It is, however, owing to its softness, and in summer, relatively high temperature, not so palatable as spring water. The relative values of spring (including well) water and that of rivers is a point difficult to be decided. In many densely populated districts the rivers are so largely polluted with sewage from towns that their waters are inferior to that of the wells. On the other hand, in purely pastoral or agricultural districts the wells are more generally contaminated with organic impurities than the rivers. The motion of the water of rivers, and the action of aquatic plants which grow in them, tend to destroy its organic impurities. As a rule, river water is soft, and spring water hard. I have often found the well waters of a district to contain from 50 to 80 grains of solid matters per gallon, whilst the rivers flowing through it held in solution only three or four grains of solid matters per gallon. Sometimes, however, there is a remarkable similarity between the water of a river and that of adjacent wells. This I found to be the case with a spring which supplies the town of Carrick-on-Suir, County of Tipperary, with water, its composition being almost identical with that of the river Clareen, as shown in the following table:—

Composition of Waters used in Carrick-on-Suir. An Imperial Gallon, 70,000 Grains, of each contains :

	Clareen Well.	Clareen River.
	Grains.	Grains.
Solid Matters	16.000	14.600
Including:—		
Albuminoid Nitrogen	0.005	0.004
Ammonia	0.003	0.002
Nitrous Acid	None.	None.
Nitric Acid	Faint trace.	Faint trace.
Sulphate of Calcium	2.100	1.500
Chlorine	0.500	0.300

Rain water, caught on the roofs of houses, is in country districts usually very pure ; but in towns and populous suburban localities it often contains soot, coal ashes, and various others matters which it meets with in its descent through the air or on the house-tops. The more serious impurities of rain water appear to be the result of the common practice of storing it in uncovered barrels or open cisterns, in situations contiguous to the ash-pit. I have frequently examined the sediment from the rain water stored in suburban houses, and almost invariably found it to contain coal ashes, vegetable refuse, and similar matters. I would, therefore, recommend that as wide a space as possible should separate the ash-pit and water cistern. Water barrels and cisterns and their conduits require to be cleaned very often ; and those vessels should be carefully covered, and the water, when required, drawn off by means of a stop-cock. The mouths of wells should be kept covered ; and if their sides be built of brick or stone, and cemented on the inside, the water will be kept free from much impure matter.

A rainfall of thirty inches per annum delivers 678,000 gallons of water per acre, or about 212 gallons on each square yard. In order, therefore, to estimate the supply of rain water, it is only necessary to ascertain the amount of the rain-fall and the area of the roof or other surface on which it is caught.

It has been calculated that one seventy-fourth part of the rain-fall would afford sufficient water for all the human beings and lower animals in England ; a less proportion would suffice for Ireland.

Mr. Bailey Denton, the eminent engineer, has suggested a method of supplying villages and small towns with good water and in sufficient quantities. He proposes to collect in reservoirs all the drainage from the subsoil when it has penetrated to the extent of about four feet. By this operation the land would be deprived of its excess of moisture, and reservoirs of very soft and wholesome water would be collected for the use of the villagers or townsfolk. In the case of a village containing 400 inhabitants, and re-

quiring for each individual a daily supply of 10 gallons, a reservoir of $7\frac{1}{2}$ feet deep, and covering 4-10ths of an acre, would be required. This pond would contain 720,000 gallons—a quantity which, making allowance for evaporation and waste in other ways, would afford 120 days' supply, without being replenished. The cost of a reservoir of this size is estimated by Mr. Denton at £415. Sanitary engineers and medical men have highly commended Mr. Denton's scheme. In seasons of drought and heat the water of such shallow ponds as those proposed by Mr. Denton would become greatly deteriorated in quality, and, perhaps, it would be a better plan to select a good water shed sufficient to supply the wants of a number of small towns and villages. The Corporation of Manchester, who have a magnificent water reservoir, supply villages twenty miles distant from the works at charges considerably under the cost of the water supplies provided by Mr. Denton's method.

Water used in towns, and even in villages, should, if at all possible, be collected at a distant place, and conveyed to the points of consumption by iron or other tubes. It is most desirable to have the water stored in a reservoir, situated at a considerable height above that of the place where it is to be used. By this means the water will be delivered with sufficient pressure to enable it to ascend to the highest points of the houses, obviating the use of the force pump. The supply should be a continuous one, for an intermittent supply necessitates the use of cisterns, and those are apt to become foul. When cisterns are used they should be frequently and thoroughly cleansed. Slate cisterns answer best when the water stored in them is soft, and either slate or iron may be used with hard waters. It is most important to keep cisterns carefully covered up, and the water should be taken from them, not by dipping vessels into their contents, but by means of stop-cocks, with high-pressure water strong pipes, and taps must be used of peculiar structure.

The Vartry water delivered in Dublin, being derived from a reservoir which is situated at a much greater elevation than the city, exerts great pressure¹ upon the water pipes, and is capable of ascending through them to a considerable height.

As under the provisions of the Public Health Act, 1874, many of the sanitary authorities are likely to supply their districts with

¹ The great danger attending the supply of water at high pressure is the bursting of house pipes, either by the force of the water or—as in the case of any other kind of water—by its sudden and rapid expansion in the act of freezing. However, by cutting off the supply where it enters the house, and leaving the mouth of the pipe open, the risk of bursting by pressure is avoided; and if the pipes be kept empty, except when the water is actually running, they cannot be burst by frost.

An arrangement known as "Kidd's patent safety apparatus" has been brought into use lately, to accomplish these objects automatically. Like many other inventions, it has been found in the actual working of it that its construction could be simplified, and, at the same time, its action rendered

good and high pressure water, the following rules relative to the use of pipe water in Dublin may prove useful:—

RULES AND REGULATIONS.

1. No "communication-pipe" for conveyance of water from the waterworks of the Corporation into any premises shall hereafter be laid until after the point or place at which such "communication-pipe" is proposed to be brought into such premises shall have had the approval of the Corporation.

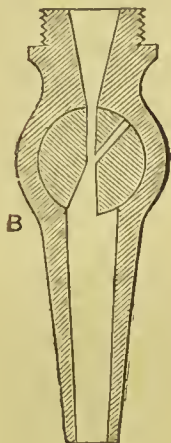


FIG. 1.

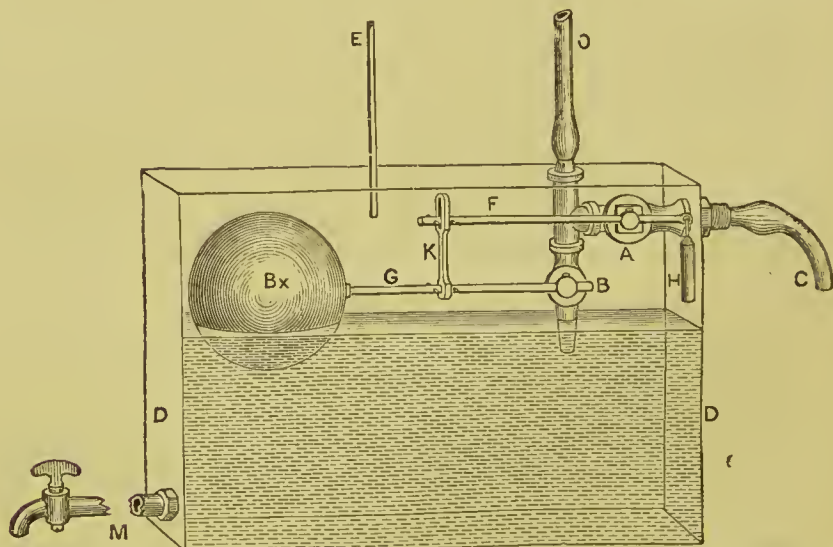


FIG. 2.

more complete. The diagrams explain its improved construction.

Two cocks, A and B, figure 3, are placed on the supply main C. Where it enters the house, a small metal tank D, similar to those used for regulating the supply to kitchen range boilers, is placed underneath, and a "notice" or overflow pipe E is conducted into this tank from the highest house cistern. The lever of cock B carries a large copper ball Bx, and is connected with the lever of cock A by a link K, also shown in fig. 2. Cock B has two apertures in it, as shown at figure 1, and discharges into tank D. From the bottom of the tank a pipe M opens, which may be taken to any distance, or have any number of branches. It is intended that all the water used in the basement story should be taken from this pipe M, and when the tank D is emptied, and the ball Bx sinks to the bottom, the

FIG. 3.



cock A opens, also the cock B, and an unlimited supply is obtained from M. When enough has been obtained and M is closed, water accumulates in tank D until the ball rises sufficiently to close cock B; the cock A now remains open, in consequence of the slot in the link K, and the water passes into the house until it fills all the cisterns, upon which the overflow comes down, completely fills the tank D, and raises the ball until it closes cock A, and opens the second aperture in cock B, allowing the water lying in the pipes to run off. Thus every time water is required in the basement it is turned on into the house, and runs until all the cisterns are full; it is then cut off at the point where it enters, and the pipes are emptied.

2. No lead pipe shall hereafter be laid or fixed in or about any premises for the conveyance of or in connection with the water supplied by the Corporation (except when and as otherwise authorised by these regulations, or by the Corporation), unless the same shall be of equal thickness throughout, and of at least the weight following, that is to say :—

Internal Diameter of Pipe in Inches.	Weight of Pipe in lbs. per lineal Yard.
$\frac{3}{8}$ -inch diameter.	5 lbs. per lineal yard.
$\frac{1}{2}$ " "	6 " "
$\frac{3}{4}$ " "	$7\frac{1}{2}$ " "
$\frac{1}{2}$ " "	9 " "
1 " "	12 " "
$1\frac{1}{4}$ " "	16 " "

Provided always, that with respect to the $\frac{3}{8}$ -inch and $\frac{1}{2}$ -inch pipes to be used for the supply of Vартry water, they may, at the option of the householder, be $3\frac{1}{2}$ lbs. weight instead of 5 lbs. per lineal yard for the $\frac{3}{8}$ -inch, and 5 lbs. weight instead of 6 lbs. per lineal yard for the $\frac{1}{2}$ -inch, respectively, which several weights are to be stated in the application and licence.

3. Every pipe hereafter laid or fixed in the interior of any dwelling-house for the conveyance of, or in connection with, the water of the corporation, must, unless with the consent of the corporation, if in contact with the ground, be of lead.

4. No house shall, unless with the permission of the corporation in writing, be hereafter fitted with more than one "communication-pipe."

5. Every house supplied with water by the corporation (except in cases of stand pipes) shall have its own separate "communication-pipe." Provided that, as far as is consistent with the special acts of the corporation, in the case of a group or block of houses, the water-rates of which are paid by one owner, the said owner may, at his option, have one sufficient "communication-pipe" for such group or block.

6. No house supplied with water by the corporation shall have any connection with the pipes or other fittings of any other premises, except in the case of groups or blocks of houses, referred to in the preceding regulation.

7. The connection of every "communication-pipe" with any pipe of the corporation shall hereafter be made by means of a sound and suitable brass screwed ferrule or stop-cock with union, and such ferrule or stop-cock shall be made so as to have a clear area of waterway equal to that of a half-inch pipe. The connection of every "communication-pipe" with the pipes of the corporation shall be made by the corporation workmen, and the corporation shall be paid in advance the reasonable costs and charges of and incident to the making of such connection.

8. Every "communication-pipe" and every pipe external to the house and through the external walls thereof, hereafter respectively laid or fixed, in connection with the water of the corporation, shall be of lead, and every joint thereof shall be of the kind called a "plumbing" or "wiped" joint.

9. No pipes shall be used for the conveyance of, or in connection with, water supplied by the corporation which is laid or fixed through, in, or into any drain, ashpit, sink or manure hole, or through, in, or into any place where the water conveyed through such pipe may be liable to become fouled, except where such drain, ashpit, sink, or manure-hole, or other such place, shall be in the unavoidable course of such pipe, and then in every such case such pipe shall be passed through an exterior cast iron pipe or jacket of sufficient length and strength, and of such construction, as to afford due protection to the water-pipe.

10. Every pipe hereafter laid for the conveyance of, or in connection with, water supplied by the corporation shall, when laid in open ground, be laid at least two feet six inches below the surface, and shall in every exposed situation be properly protected against the effects of frost.

11. No pipe for the conveyance of, or in connection with, water supplied by the corporation shall communicate with any cistern, butt, or other receptacle used or intended to be used for rain-water.

12. Every "communication-pipe" for the conveyance of water to be supplied by the corporation into any premises shall have at or near its point of entrance into such premises, and if desired by the consumer, within such premises, a sound and suitable stop-valve of the screw-down kind, with an area of waterway not less than that of a half inch pipe, and not greater than that of the "communication-pipe," the size of the valve within these limits being at the option of the consumer.

If placed in the ground such stop-valve shall be protected by a proper cover and "guard-box."

13. Every cistern used in connection with the water supplied by the corporation shall be made and at all times maintained water-tight, and be properly covered and placed in such a position that it may be inspected and cleansed. Every such existing cistern, if not already provided with an efficient "ball-tap," and every such future cistern, shall be provided with a sound and suitable "ball-tap" of the valve kind for the inlet of water.

14. No overflow or waste-pipe, other than a "warning-pipe," shall be attached to any cistern supplied with water by the corporation, and every such overflow or waste-pipe existing at the time when these regulations come into operation shall be removed, or, at the option of the consumer, shall be converted into an efficient "warning-pipe," within two calendar months next after the corporation shall have given to the occupier of, or left at the premises in which such cistern is situate, a notice in writing requiring such alteration to be made.

15. Every "warning-pipe" shall be placed in such a situation as will admit of the discharge of the water from such "warning-pipe" being readily ascertained by the officers of the corporation. And the position of such "warning-pipe" shall not be changed without previous notice to, and approval of, the corporation.

16. No cistern buried or excavated in the ground shall be used for the storage or reception of water supplied by the corporation, unless the use of such cistern shall be allowed in writing by the corporation.

17. No wooden receptacle without a proper metallic lining shall be hereafter brought into use for the storage of any water supplied by the corporation.

18. No draw-tap shall in future be fixed unless the same shall be sound and suitable, and of the "screw-down" kind.

19. Every draw-tap in connection with any "stand-pipe" or other apparatus outside any dwelling-house in a court or any other public place, to supply any group or number of such dwelling-houses, shall be sound and suitable and of the "waste-preventer" kind, and be protected as far as possible from injury by frost, theft, or mischief.

20. Every boiler, urinal, and water-closet, in which water supplied by the corporation is used (other than water-closets in which hand-flushing is employed), shall, within three months after these regulations come into operation, be served only through a cistern or service-box and without a stool-cock, and there shall be no direct communication from the pipes of the corporation to any boiler, urinal, or water-closet.

21. Every water-closet cistern or water-closet service-box hereafter fitted or fixed, in which water supplied by the corporation is to be used, shall have an efficient waste-preventing apparatus, so constructed as not to be capable of discharging more than two gallons of water at each flush.

22. Every urinal-cistern in which water supplied by the corporation is used, other than public urinal-cisterns, or cisterns having attached to them a self-closing apparatus, shall have an efficient "waste-preventing" apparatus.

so constructed as not to be capable of discharging more than one gallon of water at each flush.

28. Every "down-pipe" hereafter fixed for the discharge of water into the pan or basin of any water-closet shall have an internal diameter of not less than one inch and a quarter, and if of lead shall weigh not less than nine pounds to every lineal yard.

24. No pipe by which water is supplied by the corporation to any water-closet shall communicate with any part of such water-closet, or with any apparatus connected therewith, except the service-cistern thereof.

25. No bath supplied with water by the corporation shall have any overflow waste-pipe, except it be so arranged as to act as a "warning-pipe."

26. In every bath hereafter fitted or fixed the outlet shall be distinct from, and unconnected with, the inlet or inlets; and the inlet or inlets must be placed so that the orifice or orifices shall be above the highest water level of the bath. The outlet of every such bath shall be provided with a perfectly water-tight plug, valve, or cock.

27. No alteration shall be made in any fittings in connection with the supply of water by the corporation without one day's previous notice in writing to the corporation.

28. Except with the written consent of the consumer, no cock, ferrule, joint, union, valve, or other fitting, in the course of any "communication-pipe," shall have a waterway of less area than that of the "communication-pipe," so that the waterway from the water in the district pipe or other supply-pipe of the corporation up to and through the stop-valve prescribed by Regulation No. 12 shall not in any part be of less area than that of the "communication-pipe" itself, which pipe shall not be of less than a half-inch bore in all its course.

29. All lead "warning-pipes" and other lead pipes of which the ends are open, so that such pipes cannot remain charged with water, may be of the following minimum weights, that is to say:—

$\frac{1}{2}$ -inch (internal diameter)	3 lbs. per yard.
$\frac{3}{4}$ -inch "	5 lbs. "
1-inch "	7 lbs. "

30. In these regulations the term "communication-pipe" shall mean the pipe which extends from the district pipe or other supply pipe of the corporation up to the "stop-valve" prescribed in the Regulation No. 12.

31. Every person who shall wilfully violate, refuse, or neglect to comply with, or shall wilfully do or cause to be done any act, matter, or thing in contravention of these regulations, or any part thereof, shall, for every such offence, be liable to a penalty in a sum not exceeding Five Pounds.

32. Where under the foregoing regulations any act is required or authorized to be done by the corporation, the same may be done on behalf of the corporation by an authorized officer or servant of the corporation, and where under such regulations any notice is required to be given by the corporation, the same shall be sufficiently authenticated if it be signed by an authorised officer or servant of the corporation.

33. All existing fittings, which shall be sound and efficient, and are not required to be removed or altered, shall be deemed to be prescribed fittings by the corporation.

34. All taps, cocks, ball-taps, and regulating cisterns must be stamped (before being used) at the office provided for that purpose in the corporation stores, Winetavern-street, to insure the householder that they are of the proper pattern and bore—the charge or fee for stamping being at the rate of one penny for each article.

34. Before a connection for the supply of water can be made, or before any additional fittings can be connected to an existing service, the work must be inspected and approved by the proper officer of the corporation, and certified by him to the waterworks committee.

36. No tap or other appliance for drawing off water from the mains or pipes of the corporation, or from any pipe or pipes communicating therewith, shall be allowed hereafter to be placed in any position so that the water flow-

ing from it can flow into any drain or sewer pipe, open or covered, directly or intermediately, or into any receptacle or conduit leading to same, unless said cock or appliance shall be of a waste-preventing pattern, approved of by the corporation.

37. No licence will be given for making connection with fittings, or putting up any fittings whatever in connection with the mains or pipes of the corporation, or appliances in connection with same, to any plumber or tradesman who will not have signed an undertaking that he will not put up any fittings or use any material save in accordance with the rules and regulations as from time to time prescribed by the corporation.

38. In all these rules in which the word corporation occurs in relation to licences, supervisions, inspections, appliances, matters or things referred to in any of the above rules, or of remitting any of the said rules in any individual case, the word corporation shall include the Water Works Committee of the corporation, and all officers duly appointed by them for the purpose of licensing, supervising, inspecting, or approving or remitting the matter referred to in any of the foregoing rules.

39. All lead used for communication pipes, service pipes, or otherwise in connection with the works of the corporation for conducting or storing water, or drawn from the corporation mains or pipes, shall be alloyed¹ with tin, as prescribed by the corporation, and no lead shall be used or recognised as such unless the lead specially made and manufactured for such purposes by the Mining Company of Ireland, or by such other manufacturers as the corporation may, from time to time, name as persons to be added to this rule as having given an equally satisfactory guarantee as to the suitability of the lead, as given by the Mining Company of Ireland.

40. The corporation will not be in any way responsible for the perfection of any of the fittings, taps, or other appliances put up, or to be put up, in any house or premises for the supply of water.

FORM OF UNDERTAKING FOR SIGNATURE BY PLUMBERS.

We, the undersigned, do hereby undertake and agree with the Corporation of Dublin, that in consideration of our being respectively granted licences for the execution of works in connection with the water supply, that we will not put up any fittings or use any materials, save in accordance with the foregoing rules and regulations, a copy of which we acknowledge to have received.

Signature and Date.	Signature of Witness.

Water should not be conveyed in open conduits, for otherwise it may become contaminated with leaves of trees, ashes, dust, and other impurities. Wooden water pipes were in general use up to a comparatively recent period; but they soon rot. Where high pressure water is used earthenware pipes are hardly strong enough to be used. Iron is the usual metal employed in the construction of water mains: it has the disadvantage of being acted upon by soft water. When the latter is heated in an iron boiler it acquires a brown colour, owing to the oxide of iron which it produces. In

¹ An alloy composed of 96.5 parts of lead and 3.5 parts of tin, as suggested by me: if the water be very hard, soft or ordinary lead may be used.

the case of hot water pipes circulating heat throughout a building, and conveying warm water to different points, copper or lead should be employed in preference to iron.

The quantity of water required daily for an adult is, on the average, from $\frac{1}{2}$ to 7-10ths of an ounce per pound weight of the body. A man weighing ten stone uses about eighty ounces, or four imperial pints, of water *per diem*, of which about twenty-eight ounces form part of his solid food, and the rest is consumed in a liquid form.

The smallest amount of water daily required for personal ablutions, washing clothes and rooms, and for cooking is four gallons per head. To perform these operations thoroughly, however, requires about twenty gallons, and with this quantity, complete, hip, or shower baths may be frequently taken. Twenty-five gallons of water per head per day supplied to a house will be found ample for every purpose requiring the application of water.



CHAPTER VI.

COMPOSITION AND EXAMINATION OF WATERS.

Water in a state of absolute purity is never found naturally, and is only prepared with some difficulty. Rain-water collected in such a way as to obtain it as free as possible from impurities has always been found to be contaminated with foreign gaseous and solid matters. Bobicre (*Comptes Rendus*, 1864, p 755) found in a cubic metre from .272 to 15.666 grammes of ammonia, from 1.813 to 15.52 grammes of nitric acid, and from 5 to 19.3 grammes of common salt.

The following tables from Dr. Angus Smith's work on air and rain show the amount of impurities in rain waters. They give the summaries of a large number of experimental results:—

AVERAGES. TOTAL ACIDS OF CHLORINE AND SULPHUR.

Rain obtained from	Total Acids of Chlorides and Sulphates.	
	Grains per Gallon.	Parts per Million.
Scotland—Inland country places	3801	5.43
England „ „ „ „ „ „ „ „ „ „ „ „	6661	9.51
Scotland—Sea-coast country places, west	1.1129	15.89
German specimens, a few	1.2400	17.71
Scotland—Sea-coast country places, average	1.2760	18.23
„ „ „ „ „ „ „ „ „ „ „ „ east ..	1.4392	20.57
London, 1869	1.5217	21.74
Scotland—Towns (Glasgow not included)	1.5655	22.36
Birkenhead, near Liverpool	1.8427	26.32
Darmstadt—Germany	2.1098	30.14
St. Helen's	2.9902	42.72
England—Towns	3.0081	42.97
Manchester, 1869	3.3281	47.54
Waterloo, near Liverpool	3.3554	47.93
Runcorn	3.4559	49.37
Liverpool	3.4824	49.75
Manchester, average of 1869 and 1870 ..	3.5464	50.66
Ireland—Valentia	3.5978	51.40
Newcastle-on-Tyne	3.6789	52.55
Manchester, 1870	3.7648	53.78
England—Sea-coast, west, one specimen	4.3424	62.03
Near an Alkali Works	5.3690	76.70
Glasgow	5.5421	79.17

AVERAGES. AMMONIA.

	Ammonia. Parts per Million.
Valentia—Ireland	180
Scotland—Sea-coast country places, west ..	484
„ Inland	532

						Ammonia. Parts per Million.
Scotland—Sea-coast	„	average	...	...	...	·738
„ „	„	east	...	...	...	·992
England—Inland	„		...	...	...	1·070
„ Sea-coast	„	west	...	...	...	1·900
German specimens	...	...	...	...	...	1·910
London, 1869	...	...	...	...	...	3·450
Scotland—Towns (Glasgow not included)	...	...	...	...	...	3·820
St. Helen's	...	...	...	...	...	4·560
Runcorn	...	...	...	...	...	4·630
England—Towns	...	...	...	...	...	5·16
Liverpool	...	...	...	...	...	5·380
Manchester, 1869	...	...	...	...	...	6·360
Manchester, 1869 and 1870, average	...	...	...	...	...	6·469
„ 1870	...	...	...	...	...	6·578
Glasgow	...	...	...	...	...	9·100

AVERAGES. ALBUMINOID AMMONIA.

						Albuminoid Ammonia. Parts per Million.
Ireland—Valentia	...	...	...	...	...	·034
Scotland—Inland country places	...	...	...	...	...	·039
„ Seacoast	„	west	...	...	...	·105
„ „	„	average	...	...	...	·105
„ „	„	east	...	...	...	·106
England—Inland	...	...	...	...	...	·109
German specimens	...	...	...	...	...	·122
Liverpool	...	...	...	...	...	·159
Runcorn	...	...	...	...	...	·190
London, 1869	...	...	...	...	...	·205
Scotland—Towns (Glasgow not included)	...	...	...	...	...	·212
England „	...	...	...	...	...	·214
Manchester, 1869	...	...	...	...	...	·217
St. Helen's	...	...	...	...	...	·230
Manchester, 1869 and 1870, average	...	...	...	...	...	·251
„ 1870	...	...	...	...	...	·285
Glasgow	...	...	...	...	...	·300
England—Sea-coast country place, west	...	...	...	...	...	·400

AVERAGES. NITRIC ACID.

						Nitric Acid. Parts per Million.
Runcorn	...	...	...	...	...	·278
Scotland—Inland country places	...	...	...	...	...	·305
Ireland—Valentia	...	...	...	...	...	·370
England—Sea-coast country place	...	...	...	...	...	·371
Scotland „	„	country places, west	...	...	...	·372
„ „	„	average	...	...	...	·424
„ „	„	east	...	...	...	·476
Liverpool	...	...	...	...	...	·582
England—Inland country places	...	...	...	...	...	·749
London, 1869	...	...	...	...	...	·840
England—Towns	...	...	...	...	...	·863
Manchester, 1869	...	...	...	...	...	·886
Manchester, average of 1869 and 1870	...	...	...	...	...	1·032

						Nitric Acid. Parts per Million.
Scotland—Towns (Glasgow not included)	...	...	...	...	...	1·164
Manchester, 1870	...	...	...	...	...	1·179
St. Helen's	...	...	...	...	...	1·413
Glasgow	...	...	...	...	...	2·436
German specimens	...	...	...	...	...	2·890

AVERAGES. PERMANGANATE TEST.

Rain obtained from	Parts by weight. Oxygen required per Million Parts of Rain.	
	Instantly.	Total in a few Minutes with Acid.
Scotland—Sea-coast country places, west...	None	·018
Ireland—Valentia	"	·049
German specimens	"	·202
Scotland—Inland country places	·028	·264
" Sea-coast " average	None	·333
England—Inland "	"	·466
Scotland—Sea-coast " east	"	·649
Runcorn	—	1·090
England—Sea-coast country, west, one specimen	"	1·706
Scotland—Towns (Glasgow not included)	·179	1·879
Manchester, 1869	·197	2·050
St. Helen's	—	2·276
England—Towns	·445	2·743
Manchester, average of 1869 and 1870	·336	3·225
Liverpool	662	3·896
Manchester, 1870	·475	4·401
Glasgow	·671	10·040

Good water has no particular colour or flavour, is transparent, deposits no sediment on standing for some hours, and is well aerated. It is desirable to have it colourless and bright, but some sufficiently pure waters are slightly brown, owing to the presence of from 1 to $2\frac{1}{2}$ grains per gallon of vegetable matter, derived from peat. The Vartry water which is used in Dublin contains only 4 grains of mineral and vegetable matter per gallon, is free from sewage impurities, and yet it has a decidedly yellowish hue. Bad water often has an offensive odour and bad flavour. A gallon of water evaporated to dryness should not leave a residue weighing more than 30 or 40 grains; and this residue when burned in a platinum or porcelain vessel should not exhale the odour of burning feathers, nor produce before complete incineration a carbonaceous mass. Although it is desirable to have water sparkling and transparent, yet these qualities are often associated with an extreme degree of impurity.

The substances found in water are (1) gaseous, (2) mineral, (3) vegetable, (4) animal.

Gases.—The amounts of gases held in solution in the Thames water in 1859 were determined by Professor Miller, as follows:—

ONE LITRE OF WATER CONTAINED IN CUBIC CENTIMETRES.

	Kingston.	Somerset House.	Woolwich.
Carbonic Acid	30·3	45·2	48·3
Oxygen	7·4	1·5	0·25
Nitrogen	15	16·2	14·5
	52·1	62·9	63·05

These results prove that the river water as it flowed onwards towards the sea lost its oxygen, which was used up in oxidizing the drainage poured into the river from the London sewers. To determine the amount of gases in water a measured quantity is placed in a flask, and the latter is connected by india-rubber with a glass tube having a bulb blown on it near the point of juncture with the flask. A clamp being placed on the india-rubber tube, a little water contained in the bulb is boiled, and the steam thereby produced expels the air from the tube. Next the clamp is removed, the end of the tube is thrust under a graduated glass, filled with and inverted over mercury, and the contents of the flask (which should be quite filled, and have the capacity of a pint) is slowly boiled for nearly an hour. The quantity of gas thus collected in it is measured. Pyrogallic acid absorbs the oxygen, caustic potash the carbonic acid, and the residual gas is nitrogen. A small amount of oxygen in water shows that the latter had been contaminated with organic matter, some of which may possibly be still present in an unoxidized condition. Chloride of calcium dries the gases.

The absorption of the gases is effected as follows:—Macerate shreds of filtering paper in a fresh solution of potassic pyrogallate, and press them tightly into a bullet mould, in which the end of a fine platinum wire is placed. Dry the bullet on the sand bath, and when ready for use thrust it up into the gases. The absorption of oxygen by the pyrogallate is slow, and more than one bullet may have to be used. Coke bullets answer the purpose also. For the absorption of carbonic acid gas, bullets of moistened caustic potash attached to silver wires are used.

A gallon of water is the usual quantity sent for what may be termed a sanitary analysis of that liquid; but unless poisonous metals are to be sought for, half a gallon is a sufficient quantity. It should be placed in clean-stoppered bottle or bottles, and examined as soon as possible, by water heat to dryness.

Determination of Amount of Solids.—Evaporate on the water bath 10 ozs. of water in a platinum dish; weigh promptly (to avoid deliquescence of salts), deduct tare of dish, and obtain weight of residue. Say residue weighs 2.35 grains; multiply by 16, and the product, 37.6 grains, will be the weight of solid matters in grains per imperial gallon. Five ounces will be sufficient in the case of hard water, or if the operator have a delicate balance. If the residue is not to be burned, a light porcelain dish may be used instead of platinum, but it should be sufficiently small to fit on the balance. If metrical weights and measures be used then evaporate, (as Wanklyn suggests), 70 cubic centimetres (c. c.) which will represent a gallon, whilst milligrammes will stand for grains; this saves the trouble of converting grammes and litre into grains and gallon.

The amount of solids in potable waters varies from one grain to 400 grains per gallon. In a specimen of pump water used by the public in the city of Waterford I have recently found the enormous amount of 385.8 grains of solid matter per gallon. I believe that no water containing more than 40 grains per gallon should be used, and even that quantity is too large.

The mineral solids contained in water are chiefly calcic carbonate, sulphate (chalk and gypsum), and chloride, magnesian sulphate and chloride, sodium carbonate and chloride. For sanitary purposes it is not generally necessary to determine the quantities of earthy and alkaline salts in water, but it is desirable to estimate roughly the amount of sulphates (gypsum being an objectionable ingredient of water). A few drops of dilute hydrochloric acid and a small amount of solution of baric chloride added to a large test tube full of water gives no precipitate unless the amount of sulphuric acid be above one grain per gallon. Four grains of sulphate of calcium produce a slight turbidity, and after a short while a slight precipitate. The appearance presented on the addition of solution of baric chloride to water containing certain quantities of added sulphates may be learned by a few experiments, after the performance of which the operator will be able to *roughly* estimate the amount of sulphuric acid in waters. When the amount of sulphuric acid in water is to be determined with accuracy, the water must be concentrated, acidulated, and the sulphuric acid precipitated as baric sulphate, collected, dried, ignited, and weighed in the usual manner. In water, sulphuric acid is usually in the form of calcium sulphate, but it occurs occasionally as magnesian and sodic sulphates. In Irish well waters I have sometimes found no sulphates whatever, in others from 20 to 70 grains per gallon—the latter quantity I estimated in the pump water at the University Club, Stephen's-green, Dublin.

Chlorine often occurs in large quantities in water perfectly free from sewage; it is generally associated with calcium and magnesium, but near the coasts it is frequently found in the form of common salt. It is generally regarded with great suspicion in water (unless when

in brackish wells), because it is universally found in large quantity in sewage. When water contains large quantities of earthy salts, the presence of chlorine does not necessarily imply the presence of sewage impurities; but when we find this element in soft water, free from the influence of the sea, the probability that it has been derived from sewage is very great indeed. It is, however, important to bear in mind that water perfectly free from chlorine is free from sewage impurities, and, unless it be contaminated with a very large quantity of vegetable matter, is fit for use.

The amount of chlorine is rapidly and accurately determined by the following volumetrical method. If nitrate of silver give only a slight precipitate in the water, concentrate the latter by evaporation until it is reduced to one-fifth, or even, if necessary, to one-twentieth of its volume. Place the liquid in a beaker (over white paper or porcelain dish), and render it faintly yellow by the addition of solution of potassic chromate. Solution of silver nitrate is dropped cautiously from a burette into the water until the red colour, which appears and disappears frequently on agitation, becomes permanent, but very faint. This reaction depends upon the fact that chlorine decomposes nitrate of silver in presence of potassic chromate and other salts, and the chromate serves merely to indicate the exact moment when all the chlorine has been converted into silver chloride—for *after* that point has been attained the red chromate of silver begins to be formed. Should the water or silver solution be acid, it must be neutralized by hydro sodic carbonate; for chromate of silver is soluble in acids. The amount of silver chromate allowed to be formed must be barely sufficient to colour the water the faintest degree of red. If the standard solution of silver contains, as Wanklyn suggests, 4.79 grammes of nitrate per litre¹ of water, then every cubic centimetre of it is capable of precipitating a millimetre of chlorine. If 70 cubic centimetres of the water be taken, and that it require 7 cubic centimetres of the solution to precipitate all its chlorine, then every millimetre of chlorine precipitated is one 70,000th part of the water, and is equal to one grain weight per gallon. The amount of chlorine in inland waters varies in Ireland from a trace to 30 grains per gallon.

Organic Matter and the Products of its Decay.—The residue obtained by evaporating water to dryness is burned in a platinum or porcelain vessel; the substance which resists combustion is moistened with solution of carbonate of ammonium (solution of carbonic acid may be used), and heated cautiously until it no longer exhales an ammoniacal odour. The object of the latter operation is to restore to any lime or magnesia which may be in the residue the carbonic acid expelled from it during the combustion. The weight lost during the combustion of the ash shows the amount of “organic and volatile matters.” Formerly

¹ 1.76077 imperial pint x 0.01543 grain.

the impurity of a water was, to a great extent, estimated by the amount of loss which occurred during the combustion of its solid ingredients, but we now know that this loss is often small when the water is impure, and large when it is uncontaminated. The loss is not merely occasioned by the destruction of the organic matter in the residue, but also, and often to a far greater extent, by the loss of water of hydration from calcium sulphate, of nitrous and nitric acids, of acid from magnesian salts, and by the volatilization of chlorides. When the residue blackens very much, and exhales the odour of burning leather during ignition, it is decidedly bad. Water contains, however, sometimes from 2 to 10 grains of peaty matter, and, though free from sewage, yields a residue which blackens considerably during combustion, but does not exhale an odour resembling that of burning feathers. If there be both abundance of organic matter and nitrates, or nitrites, present, scintillations will often be observed—particles of organic matter burning brilliantly in the oxygen evolved from the acids. I have examined waters containing nitric acid in such enormous quantities that the oxygen evolved during the ignition of the residues repeatedly relighted a recently extinguished taper. The ignitions of water residues should be conducted at as low a temperature as possible, so as to avoid or lessen loss of chlorides, &c. Solution of potassium permanganate loses its red colour, and becomes brown and turbid, on coming into contact with organic matter. This change takes place because a portion of the oxygen of the permanganate readily leaves the salt, and unites with and mineralizes the organic matter. The amount of organic matter in water is approximatively estimated by ascertaining the quantity of a standard solution of permanganate of potassium decolourized by a given quantity of water. Miller recommends the following method of procedure¹:—Dissolve 0.395 grammes of crystallized permanganate in one litre of distilled water; of this solution each c.c. equals 0.000395 gramme of permanganate, or 0.0001 gramme of oxygen. The accuracy of the operation is to be tested as follows:—Dissolve 0.7855 gramme of crystallized oxalic acid in 1 litre of pure distilled water; 100 c. c. of this solution, rendered slightly acidulous with sulphuric acid, should exactly decolourize an equal quantity of permanganate solution. In using the solution place 100 c. c. of the water under examination in a beaker, add .1 c.c. of sulphuric acid, and deliver very slowly from a burette the permanganate solution until a very faint pink puce remains for half an hour or so. As the permanganate acts very slowly² on some kinds of organic matter, the operation must be extended over a period of at least three hours. It is desirable to keep the beaker protected

¹ Journal of the Chemical Society, vol. iii., p. 121.

² I found (Dublin Journal of Medical Science, Nov. 1869), ferrate of potassium to act very speedily—an observation since confirmed by Angus Smith; but this salt is not met with in the shops.

from the action of light, except when its colour is being observed. Some chemists prefer to heat the water up to from 100° to 140° Fahr., in which case the process is far more expeditiously brought to a close; but the majority of water analysts prefer, I believe, to operate with cold water. Permanganate is decolourised by other matters than organic substances—namely, nitrites, sulphuretted hydrogen, and ferrous salts; it is, therefore, impossible to state the exact amount of organic matter corresponding to the consumption of a certain quantity of permanganate solution. According to Dr. Wood, R.A., five parts of organic matter contained in sewage is destroyed by one part of permanganate, or nearly twenty parts of oxygen. The greater part of the nitrogen of sewage exists in the form of urea, which is slightly affected by permanganate, whilst in bad waters there is often a large amount of nitrous acid, which readily destroys the permanganate. When, however, the amount of this acid is known, a deduction can be made for the quantity of permanganate consumed by it. Dr. Parkes states, in his valuable work on Hygiene, that he considers Dr. Wood's numbers fairly correct when the oxidation of organic matter has not commenced; but that if nitrites, &c., be present, allowance must be made for the quantity of the permanganate expended on them. Dr. Letheby considers that the relation between the oxygen of the permanganate and the organic matter is as 1 is to 8. His observation had reference to the water supplies of London. According to Frankland, gelatin, urea, and hippuric acid are scarcely affected by permanganate.

Determination of Albuminoid Nitrogen and Ammonia.—When more than two or three c. c. of the standard solution of permanganate is used up, the water contains a large amount of oxidizable matters.

Water containing very small quantities of nitrogen compounds may yet be impure. Some well water, suspected by Dr. Buchanan to have been instrumental in the spreading of typhoid during an outbreak of that disease at Wicker Bonant, Essex, was examined by the late Professor Miller. He found it contain 0.003 grain of ammonia and 0.006 grain of organic nitrogen per gallon. Dr. Burdon Saunderson found this water teeming with monads, bacteridiæ, amœbæ, paramecia, and other low forms of life.¹

Fresh sewage contains the merest traces of nitrites and nitrates, and it is even very free from ammonia. It includes urea, kreatin, and nitrogenous matters, more or less highly organized. The animal and vegetable substances present which contain nitrogen, but excluding urea and hippuric acid, are termed albuminoids. They are, for the most part, organized nitrogenous matters in a state of retrograde metamorphosis. They gradually become simpler in structure, and, after a certain time, their nitrogen separates in the form of ammonia. The latter is subsequently oxidized into nitrous acid, and finally converted into nitric acid. When sewage enters

¹ Twelfth Report of Medical Officer of Privy Council, 1869.

into potable waters the same changes take place. Ammonia, nitrous acid, and nitric acid are innocuous ingredients of water, and if we were certain that all the combined nitrogen existing in a water was in the form of one or all of these substances, we might drink it in contentment; but when we find abundance of nitrous acid, nitric acid, and ammonia in water, we fear that at any moment some of the albuminoid matter from which those substances are derived might make its appearance in the liquid substance. Albuminoid matter is dreaded because it may have been, at no remote period, a portion of the ejecta of a typhoid patient, and pregnant with the germs of that disease. Albuminoid nitrogen is, therefore, now regarded as the true indicator of the degree of water contamination. In good waters the amount of this substance varies from an inappreciable amount to about 0.003 (three thousandths) of a grain per imperial gallon. Tolerably good waters may contain 0.005 or 0.006 grain per gallon; indifferent waters up to 0.008, but when the second place of decimals is reached the water is certainly bad. I have found nearly one grain of albuminoid nitrogen in a gallon of well water.

The amount of ammoniacal nitrogen in water is usually less than that of albuminoid nitrogen. In good waters it is from 0.0002 to 0.002 grain per gallon, in indifferent waters from 0.006 to 0.008, in bad waters from 0.01 to 0.5. Sometimes, however, the amount of ammonia in a bad water greatly exceeds that of albuminoid nitrogen. I found a remarkable instance of this in a so-called spa at Portobello, Dublin. The albuminoid nitrogen amounted to a mere trace, whilst the free ammonia was present in the excessive proportion of half a grain per gallon. In this case the ammonia evidently was washed into the well from an adjacent deposit of putrefying matters. The soil retained the albuminoids, and permitted the passage of the ammonia. Frankland and Armstrong determine the amount of albuminoid nitrogen by destroying the nitrites and nitrates by sulphurous acid, evaporating the water to dryness, and burning the residue, according to the method employed in ordinary organic analysis. Water, carbonic acid, and nitrogen are obtained, and the weight of the latter multiplied by 6.5 gives the amount of albuminous matter present in the water. Several objections are urged against this method, one being that the organic matter is, to some extent, destroyed during the evaporation of the water to dryness. I prefer the method devised by Wanklyn, Chapman, and Smyth, and which is described fully in Wanklyn's *Water Analysis*.¹ In order to explain this process it will be necessary, first, to describe the preparation and use of Nessler's test for the detection of ammonia. This reagent, devised by Nessler, is prepared as follows:—25 grammes of potassium iodide are dissolved in 120 c. c. of pure distilled water, and to this mixture there is added a cold and concentrated solution of mercuric chloride (corrosive

¹ Third Edition. London: Trübner & Co., Ludgate-hill. 1874. *

sublimate), until the mercuric iodide, which at first forms and then dissolves by agitation, at length produces a very small permanent precipitate. 100 grammes of caustic potash are next dissolved in 200 c. c. of water, and added to the solution already made, and the whole is then made up to a volume of 500 cubic centimetres by the addition of water. After standing for an hour the solution is decanted into a stoppered bottle, from which small quantities are from time to time transferred to a small bottle for immediate use. The solution has a pale yellow hue.

Nessler's solution is so exceedingly delicate a test for ammonia that it indicates the presence of the latter when dissolved in 20,000,000 times its weight of water. If water contain 0.005 grain of ammonia per gallon, it acquires a light straw colour on the addition of Nessler's solution. 0.01 ammonia gives a very yellow hue, and 0.1 grain a deep brown precipitate. The brown colouration is caused by the production of tetramercurammonium iodide.

The water to be tested is distilled with a little carbonate of sodium, and the ammonia which passes over is estimated by comparing the colour which its solution in distilled water gives with Nessler's test, as compared with the colour imparted by the same test to a standard solution of ammonia. The free ammonia being expelled, the residue of the water is boiled with potash and permanganate of potassium, by which means its albuminoid nitrogen is converted into ammonia, and the amount of the latter is determined by Nessler's solution. Wanklyn's directions relative to these operations are as follows:—

Dilute standard solution of Ammonia.—It will be found convenient to keep two solutions, a stronger solution and a weaker solution. The stronger solution is made by dissolving 3.15 grammes of chloride of ammonium in one litre of distilled water. (The commercial sal ammoniac, in dry fibrous crystals, answers very well for the purpose.) If the solution be prepared, as has just been described, it will contain one milligramme of ammonia in one cubic centimetre of solution. The weaker solution is prepared by diluting the stronger one with 99 times its volume of distilled water. The weaker solution, which therefore contains $\frac{1}{100}$ milligramme of ammonia in one cubic centimetre, is generally useful.

The solution of Potash and Permanganate of Potash is made by dissolving 200 grammes of solid potash and 8 grammes of crystallised permanganate of potash in a litre of water. The solution is boiled for some time, in order to get rid of all traces of ammonia and organic nitrogenous matter; and after about one quarter of the liquid has boiled off, it may be filled up with pure distilled water, so as to bring the solution up to the litre. Each water analysis requires 50 c. c. of the solution; wherefore each analysis consumes 10 grammes of potash and 0.4 grammes of permanganate.

Carbonate of Soda.—A saturated solution of carbonate of soda may be prepared by boiling an excess of the common carbonate with water; and about 10 c. c. of the solid saturated aqueous solution is the proper quantity to use in a water analysis. Instead of solution the recently ignited solid carbonate may be employed. The object of the carbonate of soda is to expel the free ammonia from water which is acid. It is, however, as a rule, not necessary to employ it.

Distilled Water.—This is required for the making up of the various

standards of ammonia, as will presently be explained. It must be very free from ammonia; so nearly free that in 100 c. e. of it there is not .005 milligramme of ammonia. Such water is not to be bought; but has to be prepared by the water analyst expressly for the purpose. A good river or spring water is distilled in a clean retort or still, and the first portions of distillate are rejected. By-and-bye water will distil over in a state of sufficient purity. The distillation must not be pushed too far, otherwise the latter portions of the distilled water may contain ammonia. In my own laboratory I make the same retort and condenser serve for the preparation of distilled water and for the performance of water analysis.

Retort.—The size of retort which is suitable for water analysis holds rather more than a litre when it is quite full. The retorts should be tubulated, and may be either corked or stoppered; the latter, however, seems preferable.

The Leibig's Condenser.—A large condenser will be found to be suitable. In my own laboratory I use a large copper condenser, 60 centimetres long and 7 centimetres in diameter; the glass tube which passes through it having a diameter of about 3 centimetres and a length of about 90 centimetres. As will be perceived, the glass tube of the condenser is wide enough to admit of the beak of the retort entering it, without being drawn out by the blow-pipe. The most convenient packing is a little writing paper, which is wrapped round the neck of the retort where it enters the tube of the condenser.

Lamp and Retort Holder.—A large Bunsen burner affords a convenient source of heat during the distillation. As will be explained, we apply the naked flame to the retort. The retort-holder should be very steady and massive. We are in the habit of using a very well-known description of clamp made of metal, and lined with cork where it clips the neck of the retort. The incline of the retort-holder must be carefully adjusted to the incline of the condenser, so that the retort may be retained in position without any unnecessary pressure. The employment of a ring to support the retort from below is not to be recommended. Much of the ease of the working of the process depends upon the proper mounting of the retort, which ought to admit of the easy removal of the retort and easy remounting of it.

Glass Cylinders for Nessler Test, or Nessler Glasses.—These should be of perfectly white glass. In my own laboratory the Nessler glasses are cylinders,¹ 17 centimetres in height and 4 centimetres in diameter. They are marked with a file-mark at 50 c. e. capacity. From half a dozen to a dozen are necessary. I use also a white porcelain tile for them to stand upon when they are used.

A half-litre flask to measure out the sample of water is required. It should never be used for organic fluids, and indeed it is best to keep it exclusively for water.

The measure for solution of Potash and Permanganate of Potash is a convenient glass, with a simple mark at 50 c. e. capacity. To pour well is an essential qualification that such a glass should possess. I am in the habit of using a thick glass vessel, which is an apothecary's dispensing four-ounce measure, and which I bought in an ungraduated state.

A *Graduated Burette*, divided accurately into cubic centimetres, and provided with a glass stopcock, is used for measuring out the dilute standard ammonia. It is held by any convenient holder.

The Pipette for Nessler Reagent is made of a piece of glass tube, and requires just one file-mark at the 2 c. e. capacity.

Bottles are required to hold the different solutions. It is of importance that the bottle holding the solution of potash and permanganate of potash should pour well. A large glass funnel is also required.

The convenience of having a water supply and sink close at hand will be readily appreciated. It will also be found to be advantageous to keep a table, or part of a table, appropriated exclusively to water analysis, and to appro-

¹ Largest size test tubes answer very well.—C. A. C.

Distillation of Water for Nitrogen Compounds. 67

priate a set of apparatus to it. Thus the funnel, the half-litre flask, the retort and condenser, burette, pipette, and Nessler glasses should not be used for anything else but water analysis.

One very important matter in testing of this order of delicacy is the cleaning and washing out of the apparatus, and it should be borne in mind that all glass surfaces which have been exposed to the air for any length of time are liable to contract traces of ammonia from the air; and the rule which has to be observed, in order to ensure accuracy, is to wash out with clean water immediately before use. Furthermore, it may be remarked that for these washings it is unnecessary to employ distilled water; and that the ordinary town water is, as a rule, everything that can be desired for the purpose. There should, however, be no stint of the quantity of water. The analysis is performed in the following manner:—

The retort having been washed out with a little strong acid (either hydrochloric or sulphuric acid), is then washed out with good tap-water, until the few drops which drain out do not taste acid. It is then mounted in its holder, and properly connected with the Liebig's condenser, either by means of a wide india-rubber tube or else it is just packed into the condenser by means of a little writing paper. Half a litre of the sample of water is next measured in the half-litre flask, and poured into the retort through a large funnel kept specially for the purpose. Then the stopper or cork, which must be kept scrupulously clean, is put into its place in the retort, and the Bunsen lamp is lighted, and the flame applied externally to the naked retort. The retort must be thrust right down into the flame, which, however, must not play upon the surface of the retort higher than the level of the liquid within the retort. In a few minutes the contents of the retort will begin to boil, and the water will begin to distil over. The distillate is to be collected in the glass cylinders for the Nessler test.

When 50 c. c. of distillate have distilled over, the cylinder is to be changed. The first 50 c. c. should then be *Nesslerised*, which will be explained further on. The distillation is to be continued until 150 c. c. have come over, and the 150 c. c. of distillate is to be thrown away. Having done so, and thereby reduced the contents of the retort from 500 c. c. (the quantity originally taken) to 300 c. c., the distillation is stopped for a moment.

Fifty cubic centimetres of the solution of potash and permanganate of potash, which has been described, is then to be poured into the retort through a wide funnel, and the distillation proceeded with.

At this stage of the operation it is sometimes necessary to shake the retort gently, in order to avoid bumping. This is especially the case in the analysis of very bad water. With a little practice, and a little presence of mind, the operator will very easily overcome difficulties of this description. The distillation must be continued until 50 c. c. of distillate have come over, and this must be collected in a cylinder for Nesslerising. A second 50 c. c. must be collected in another Nessler cylinder, and a third 50 c. c. must be collected; and that having been done the distillation may be stopped, and the apparatus left standing until it is required for another analysis. * * * *

Let it be required to tell how much ammonia is present in 50 c. c. of distillate contained in one of the cylinders above mentioned. For this purpose 2 c. c. of Nessler reagent are dropped into the 50 c. c. of distillate. This is best done by aid of the appropriate 2 c. c. pipette above mentioned. The pipette also serves as a convenient stirrer, to stir up the liquid after the addition of the Nessler reagent to it. If the 50 c. c. of distillate contain any ammonia, it will soon after the addition of the Nessler reagent, as just described, assume a rich brown colour; and the more the ammonia, the deeper the colour.

The next step is to imitate the depth of the colour given by the distillate. In order to do so, a clean cylinder is taken, and into it is dropped a certain measured volume of the standard solution of weak ammonia, which is filled up with distilled water to the 50 c. c. mark on the cylinder. Two cubic cent. of Nessler reagent is then dropped into it by means of the pipette, and the whole is very thoroughly stirred up. The 50 c. c. of distillate in its appro-

priate cylinder, and the 50 c. c. of water containing the standard ammonia are then placed side by side on a white surface (a white porcelain tile answers very well), and carefully looked through, and a judgment is arrived at as to which is of the deeper colour. If they be of equal depth, the Nesslerising is accomplished, inasmuch as the quantity of ammonia required to imitate the colour which Nessler reagent imparts to the distillate is the quantity of ammonia in the distillate. If the two solutions be not of equal depth, another standard must be made up with water, dilute standard ammonia, and Nessler reagent, and another comparison must be made.

With a little practice Nesslerising becomes very easy.

In the course of a water analysis it will be perceived that ammonia is to be looked for at two stages; firstly, before the addition of the potash and permanganate, and secondly, after the addition of the potash and permanganate. The ammonia which comes over in the first stage is the "free ammonia," and that which comes over in the second stage is the "albuminoid ammonia."

The recommendation has been given to Nesslerise only the first 50 c. c. of free ammonia, and to throw away the next 150 c. c. Formerly it was our custom to Nesslerise all four 50 c. c. of free ammonia; but that was a useless trouble, inasmuch as the first 50 c. c. invariably contains three-quarters of the total amount of free ammonia. The rule is, therefore, to Nesslerise the first 50 c. c. of free ammonia, and then to add one-third. Thus, if in the first 50 c. c. of distillate the quantity of ammonia were found to be 0.02 milligramme, the total free ammonia would be 0.027 milligramme.

In the instance of the albuminoid ammonia, it is necessary to Nesslerise each separate 50 c. c. of distillate, and to add the amount together, in order to arrive at the total albuminoid ammonia.

Since half a litre of water is taken for the analysis, the results must be multiplied by two, in order to make them count upon the litre; and if that be done, we shall then have the "free ammonia" and "albuminoid ammonia" expressed in milligrammes per litre, or in parts per million (which is the same thing).

The following example of the manner in which the notes of a water analysis are kept in the laboratory may be useful.

Half a litre of water was taken for analysis,

Free ammonia	.	.	.	·01 milligrammes
(Correction)	.	.	.	·003 "
				·013
Albuminoid ammonia	.	.	.	·035 "
"	.	.	.	·015 "
"	.	.	.	·000 "
				·05
Therefore, in litre—Free ammonia	.	.	.	=·026
Albuminoid ammonia	.	.	.	=·10

If the amount of ammonia be very large in water, it should be diluted with three or even ten times its bulk of pure water before Nesslerising it. It need hardly be added that the retort, condenser, receiver, and fittings generally should be scrupulously clean, and free from ammoniacal or nitrogenous matter. The amount of free ammonia may be roughly estimated without distilling the water. Should Nessler's solution produce a precipitate of earthy salts (which happens when the water is hard), the intensity of the colour cannot be properly observed. In such case add a few drops of caustic potash solution to the water, and after the subsidence of the precipitate, Nesslerise.

Nitrous and Nitric Acids.—There is no reliable method for estimating nitrous acid. Add to an ounce of water one of dilute hydrochloric acid, or of acetic acid, a few drops of solution of iodide of potassium, and half an ounce of thin solution of starch. If there be much nitrous acid present a violet colour will be produced very soon—sometimes a deep violet colour is at once developed. When the nitrous acid is in minute quantity no colouration appears, even after the expiration of some hours. For the determination of nitrogen in the form of nitric and nitrous acids, there are several methods in use. Chapman's modification of Schulze's method is probably the best.

The process is carried out as follows:—50 c. c. of the water are introduced into a non-tubulated retort, and 50 to 70 c. c. of a solution of caustic soda added. The caustic soda must be free from nitrates, and the strength of the solution should be such that 1 litre contains 100 grm. of caustic soda. If necessary, the contents of the retort may be distilled until no ammonia comes over; that is, until the Nessler test is incapable of detecting ammonia in the distillate. The retort is now cooled, and a piece of aluminium¹ introduced into it (foil will answer very well with dilute solutions, but we much prefer thin sheet aluminium in all cases). The neck of the retort is now inclined a little upwards, and its mouth closed with a cork, through which passes the narrow end of a small tube filled with broken-up tobacco-pipe, wet either with water, or, better, with very dilute hydrochloric acid free from ammonia. This tube need not be more than an inch and a half long, nor larger than a goose-quill. It is connected with a second tube containing pumice-stone moistened with strong sulphuric acid. This last tube serves to prevent any ammonia from the air entering the apparatus, which is allowed to stand in this way for a few hours or over night. The contents of the pipe-clay tube are now washed into the retort with a little distilled water, and the retort adapted to a condenser, the other end of which dips beneath the surface of a little distilled water free from ammonia (about 70 to 80 c. c.)² The contents of the retort are now distilled to about half their original volume; the distillate is made up to 150 c. c.; 50 c. c. of this are taken out, and the Nessler test added to them. If the colour so produced be not too strong, the estimation may be made at once; otherwise the remainder of the distillate must be diluted with the requisite quantity of water.

Should it be desired to determine the ammonia by titration (alkalimetry), a much larger quantity of the water must be employed. Half a litre or a litre should be evaporated down to a small bulk, and treated in exactly the same manner, except that the distillate is received in standard acid instead of water.

The following rough method of estimating, or rather *guessing*, the amount of nitrates in water may prove of some use to health officers. Make a saturated solution of ferrous sulphate in 10 c. c. of the suspected water, and float it gently on strong sulphuric acid, contained in a narrow test tube. If there be much nitric acid present, a brown stratum will soon make its appearance at the juncture of the two liquids. Note the size and colour intensity of

¹ A mixture of filings of iron and zinc may be substituted for aluminium, but not advantageously.—C. A. C.

² Condensers are very apt to obtain a trace of ammonia if they have been standing all night, and must, therefore, be washed out with the utmost care. We prefer to distil a little water through them until ammonia can be no longer detected in the distillate.

the strata produced in water containing 1, 2, 5, &c., grains per gallon of nitric acid, and compare results with those arrived at in the case of suspected waters.

Water in which the only nitrogen compound present is the harmless nitric acid is still regarded with suspicion by most sanitary chemists, from the supposition that the germs of disease in polluted water may survive the almost complete oxidation of the dead organic matter. When, therefore, large amounts of nitric acid are found in water, chemists, following the example of Frankland, pronounce the nitric acid to be evidence of "previous sewage contamination."

It is a fact that much larger amounts of nitrogen are found in water in the form of nitric acid than in that of ammonia or of organic matter; and I have no doubt that in limestone districts water which had never been contaminated with sewage often contains very large quantities of nitric acid. I have rarely found in a water obviously contaminated with sewage more than half a grain of organic and ammoniacal nitrogen per gallon, whilst in waters far removed from all obvious sources of animal impurities I have often detected from two to five grains of nitric acid per gallon. The waters of two pumps which I have constantly been testing for the last two years never contain sufficient ammonia to give the slightest colouration with Nessler's test, nor do they contain any nitrous acid, and yet they include enormous quantities of nitric acid. I have not the slightest doubt as to the wholesome character of these waters, notwithstanding the large quantities of nitric acid contained in them. This point is worthy of careful consideration. Is the nitric acid found in well water always derived in great part from effete animal matter? In the case of soft waters I have no doubt that the nitric acid present is derived from sewage. When we find a water containing only from four to ten grains of solid substances per gallon, we may safely regard the nitric acid present in it as evidence of previous sewage pollution; but the case is very different with hard waters—those most abundant in Ireland, and which contain from 20 to 150 grains of calcium and magnesium salts per gallon. In the presence of lime, and even of limestone (calcic carbonate, more or less impure), the decomposition of organic matter proceeds rapidly, and its nitrogen is soon converted into nitric acid. The soil possesses the power of retaining ammonia, alkaline phosphates, and most of the other materials which contribute to the nutrition of plants; but nitrates pass readily out of the soil, and are usually found (and often in large quantity) in the drainage water. Plants usually contain, when dried, about two per cent. of nitrogen; therefore the portions of them which decompose on or in the soil produce no inconsiderable amount of ammonia or nitric acid. The well water—which is simply drainage water—in limestone districts is, therefore, very likely to contain nitric acid (derived from decomposed vegetable matters), which the soil was not capable of retaining until appro-

priated by plants. I can also conceive that the nitric acid produced in the soil by the decay of manure, which is chiefly altered animal substances, and straw, may be carried into the wells, whilst the albuminoid nitrogen, ammonia, and other matters would be retained in the soil.

I frequently notice that water containing a large amount of nitric acid, but no other nitrogen compound, is almost completely free from chlorine. When water is unmistakeably contaminated with sewage, it invariably contains a large amount of chlorine, chiefly in the form of common salt. Water, however, may contain an abundance of chlorine, and yet be free from nitrogen in any form. The wells near the sea occasionally contain common salt; and in many parts of Ireland, and particularly in the city and county of Dublin, the well waters often include very large amounts of earthy chlorides. In a soft water, remote from the sea, the decided presence of chlorine and nitric acid should be considered as clear evidence of previous sewage pollution, and such water should be regarded as dangerous to health.

THE FOLLOWING TABLE SHOWS THE AMOUNT OF NITRIC ACID WHICH I HAVE FOUND IN SOME SPECIMENS OF PUMP WATER:—

An imperial gallon contains in grains:—

	Vartry water	Rock-st. pump, Tralee	Holyhead (Wales) Work- house	Gort Work- house	Stillorgan, county Dublin	Public pump, Water- ford	Barrack- street pump, Athy	Thomas- street, Dublin
Solids per gallon }	4.25	201.72	43.52	118.83	65.75	35.17	81.17	98.90
Nitric Acid, Faintest trace		5.68	4.60	6.94	7.15	10.00	5.70	15.00

The composition of the Waterford well water is so very peculiar that I think it desirable to give a somewhat detailed account of it here.

COMPOSITION OF THE WATER FROM A PUBLIC PUMP, WATERFORD.

An imperial gallon contains:—

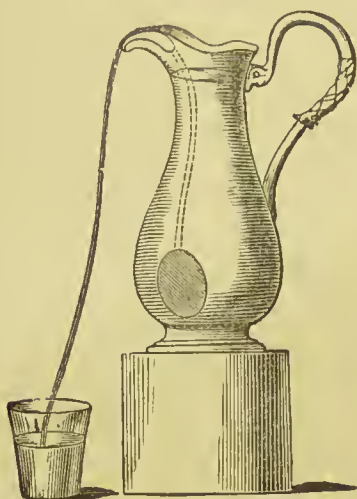
Solid matters,	...	...	...	...	70.100 grains.
Including:—					
Calcium Sulphate (Gypsum),	...	...	...	...	30.200 "
Chlorine, ...	...	...	...	...	13.000 "
Organic Nitrogen,	...	...	...	...	0.400 "
Ammonia, ...	...	...	...	...	4.060 "
Nitrous Acid,	...	...	...	...	Decided trace.
Nitric Acid,	...	...	...	...	3.000 "

The water was tolerably clear, but possessed a faint urinous odour. The chlorine was chiefly in combination with calcium and magnesium; and although the solids amounted to 70 grains per gallon, they did not include even a trace of calcic carbonate. I have looked in vain through the medical and scientific journals for the results of water examinations showing anything approaching to the enormous quantity of ammonia present in this remarkable water from Waterford.

CHAPTER VII.

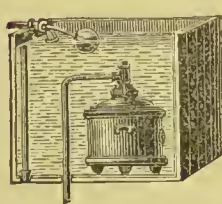
PURIFICATION AND SOFTENING OF WATER.

Water is freed to a great extent from impurities suspended mechanically in it by filtration through sand. The water supplied



Syphon Filter No. 1.

to large towns is filtered in this way, but very often the filtering material is impure, and still more frequently it is kept too long in use without cleansing or renewal. Water filtered through animal charcoal is deprived of nearly all its organic matter. I have reduced the amount of organic matter (chiefly vegetable) in a water-pot 3·4 grains to 0·2 per gallon by filtering it through a layer of animal charcoal 2½ inches in depth. It is, however, doubtful whether or not the germs of typhoid fever and Asiatic cholera which undoubtedly exist in water can be perfectly removed by filtration on a small scale; still, water which has been carefully



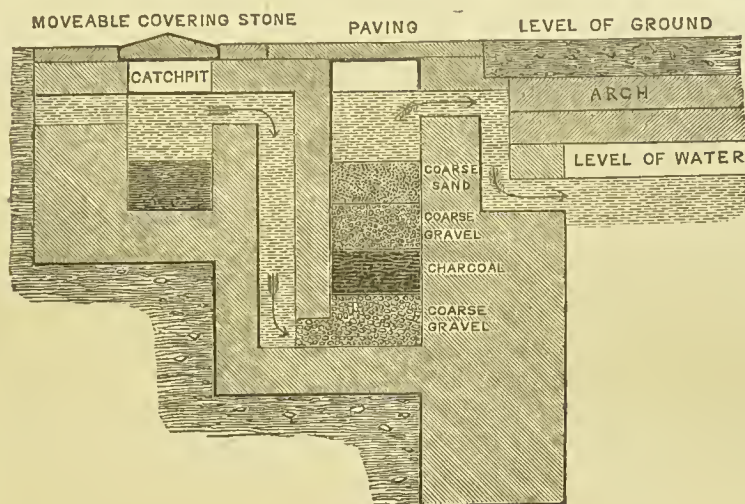
Syphon Filter No. 2.

filtered through a deep layer of animal charcoal is far less likely to possess zymotic power than the same water unfiltered. Frankland found that filtration of water containing "rice water" discharges from cholera patients did not remove the poison of the disease.

The syphon filter consists of a block of charcoal, in the centre of which a tube is inserted. The block is placed in the water, and the latter percolates into the tube, from which it may be sucked out by a tube of vulcanized india rubber. The elastic tube may be filled with water and used in the ordinary manner of a syphon. Travellers would find a small syphon filter useful, as they might be obliged to drink water of a doubtful quality.

Messrs. Maguire and Son, Dawson-street, Dublin, prepare a very good charcoal filter, which I have found to work well. "Magnetic carbide of iron," wood and peat charcoals, and other materials are used in filter beds; but they are far inferior in purifying power to animal charcoal. Occasionally we meet with this substance in so impure a state that it renders the water passed through it undrinkable. It should be treated with hydrochloric acid (to dissolve the earthy salts which it contains), and washed repeatedly with water until the latter no longer acquires a disagreeable flavour from the charcoal. There is a great variety of filters on sale now, from

the small syphon filter placed on the table to the large ten-gallon cylinder capable of filtering fifty gallons a-day. When a large quantity of water is to be filtered an arrangement such as that



shown in the engraving may be employed. Every filtering bed of moderate size should be covered in.

Condy's liquid (solution of permanganate of potassium) may be used to destroy organic matter and sulphuretted hydrogen in water; it, however, often imparts to the water a brownish hue. It is doubtful whether or not permanganate has the power to destroy the germs of disease, supposing such bodies to exist, in the same way that it is known to destroy organic matter. It has little or no effect upon urea.

Alum may be used advantageously to precipitate the matters suspended in very muddy waters: from three to six grains per gallon of water may be used when there is reason to apprehend that water might possibly be contaminated with disease germs; then, if it must be used, the most effectual way to render it innocuous is to boil it for fifteen minutes. Water which has lost its gaseous constituents by boiling is very insipid; but to a great extent it may be aerated, by pouring it from one vessel into another for about thirty times.

Hardness.—Water is said to be "hard" when it produces curds instead of a lather on treatment with soap. This hardness is due to the presence of earthy salts—chiefly chalk and gypsum. In many parts of Ireland the spring waters contain great quantities of magnesian and calcium salts. This is remarkably the case in Dublin city and county. The rock formation underlying the city and suburbs of Dublin is limestone mixed with black shale, and is known to geologists by the term *calp*. Resting on the solid rock there is a stratum of impure limestone-gravel, averaging about 40 feet in depth. In several parts of the bed of the river Dodder

dolomite, or magnesian limestone occurs, and this is especially the case in the neighbourhood of Milltown. It is the drainage of this limestone gravel that constitutes by far the larger portion of the well water of Dublin and its suburbs. In a few parts, however, of the southern suburbs the superficial wells are supplied by drainage from the dolomitized limestone. As might be expected, the Dublin well water is very hard, and is not suited for detergent purposes. It is, however, owing chiefly to its large amount of carbonic acid and low temperature, a well flavoured water, even when it contains excessive quantities of earthy salts.

There is one peculiarity of the Dublin well waters which is worthy of notice—that is, that whilst in some of them there are only minute traces of gypsum, in others there are from 10 to 90 grains per gallon of this most undesirable ingredient. In many specimens I have found more than 25 grains of gypsum. In the water of the pump at the University Club, St. Stephen's-green, I found the enormous amount of 168 grains of solid matter per gallon, of which no less than 84 grains were sulphate of calcium, 30 grains of chloride of calcium, and 20 grains of chloride of magnesium. There were only 2 grains of organic matter in this curious water;¹ and I have generally found that waters in which large amounts of gypsum occur do not contain much organic matter. The presence in water of more than 3 grains per gallon of sulphate of calcium is considered to be injurious. Water containing from 5 to 10 grains per gallon of this ingredient is, I know, constantly drank without invariably producing disease, but it is impossible that water like that of the University Club pump could be used with impunity. Indeed, I have learned that persons who drank this water suffered much from dyspepsia and severe diarrhœa, the cause of which was inexplicable to them until the nature of the water which they drank was ascertained.

The presence of enormous amounts of sulphate of calcium in some of the superficial wells of Dublin appears the more surprising from the fact that the drainage does not come in contact with selenite or beds of plaster of Paris. The circumstance may, however, be explained in this way:—There is a large amount of amorphous sulphide of iron in the black shale, which, as I have already stated, enters into the composition of the calp: by oxidation this sulphide of iron is converted into sulphate of the same metal, and the sulphate reacting upon the carbonate of calcium (which is the most abundant constituent of the calp) produces sulphate of calcium and carbonate of iron.

The “hardness” of water is due to the presence of compounds of lime and magnesia. Carbonate of calcium, or chalk, is the most common cause of the hardness of water. This substance is not soluble in pure water, but a solution of carbonic acid gas

¹ This analysis was made before the determination of ammonia, &c., in water was in use.

readily dissolves it. Spring, well, and even river waters contain carbonic acid, and often in large quantities, and when they come in contact with chalk they dissolve it. If these kinds of water be boiled they become soft, because the carbonic acid gas is driven off, and the chalk having lost its solvent is thrown down in a solid form. This is the most common cause of the earthen incrustation in boilers, tea-kettles, and similar vessels. When the hardness of water is due to the sulphates of calcium and magnesium, and the chlorides of calcium and magnesium, then boiling will not soften it, as all those salts are more or less soluble in pure water. The waters of the Dublin canals, and some of its wells, may be rendered soft by boiling, but most of the pump waters which I have examined are permanently hard.

I shall now explain why it is that hard water is not suitable for detergent purposes. Soaps are the products of the action of alkalies upon animal or vegetable fats and oils. Fats are compounds of glycerine with various substances, such, for example, as oleic acid, stearic acid, and palmitic acid—which, however, are not, as their names might imply, sour to the taste. When a fat is boiled in a solution of an alkali, say soda, the glycerine is displaced by the alkali, and a soap is formed. The soaps of the alkalies, potash and soda, are soluble in water; but there are other soaps—for example, those containing lime—which do not dissolve in that fluid. When, therefore, we try to wash with hard water, the lime decomposes the soda soap, and uniting with its fatty acid, forms an insoluble compound, or curd.

All the earthy salts render water hard and cause a great waste of soap. When the hardness of water is due to the presence of chalk, simple boiling will prove an effectual remedy, provided the water be not used until the chalk has subsided from it, and the clear fluid is decanted off the sediment. Clark's process for softening this kind of water consists in adding lime water to it. The excess of carbonic acid, which holds the chalk in solution, unites with and throws down the lime, and the chalk having lost its solvent is precipitated at the same time. The difficulty in carrying out this process is to ascertain the proper quantity of lime water to employ; for if an excess be applied, the remedy will be worse than the defect. I think, however, that the addition of 5 gallons of lime water to 100 gallons of tolerably hard water will never prove an excessive quantity, and will be certain to improve the quality of the water.

Dublin is supplied with water from the Vartry, a river which drains an area of 22 square miles of mountainous district in the county of Wicklow. The water is conveyed through huge iron tubes from the great reservoir (420 acres in extent) at Roundwood, a distance of 22 miles; and is sufficient in quantity to supply 12,000,000 gallons per day, or 35 gallons per head of the population who are expected to use it. The undertaking has cost the citizens above £500,000, but it is my firm conviction that the

money has been well expended, and that the abundant supply of pure water now provided for the city will greatly tend to promote the health and comfort of the citizens.

The Vartry water is, as I have already shown, extremely pure, containing, as it does, only two grains of mineral matter, and two grains of organic matter, per gallon. By its use a large quantity of soap is saved to the citizens; and clothes can be washed in it with less friction. A bath in this extremely soft liquid is an enviable luxury. Hard water is not even suitable for cooking food. It does not extract all the soluble matter from meat, and therefore should not be used in preparing soup. Infusion of tea made with hard water is often perfectly undrinkable, and in any case the lime renders a portion of the more valuable ingredients of the tea insoluble and useless. Peas and some other vegetables, when boiled in very hard water, do not lose their hard texture. I have performed a great many experiments with the Vartry water, from the results of which I have come to the conclusion that the use of such water, for detergent and cooking purposes, effects a considerable saving in the expenditure of the Dublin public for clothes, soap, and food.

Clarke's method of softening water has recently been adopted on a somewhat large scale in England, and it is likely to become more generally employed; I therefore give his method *in extenso*, as it appears in the specification of his patent, enrolled 8th September, 1844:—

Preparation of the Soap Test.—Sixteen grains of pure Iceland spar (carbonate of lime) are dissolved (taking care to avoid loss) in pure hydrochloric acid; the solution is evaporated to dryness in an air-bath, the residue is again redissolved in water, and again evaporated; and these operations are repeated until the solution gives to test-paper neither an acid nor an alkaline reaction. The solution is made up by additional distilled water to the bulk of precisely one gallon. It is then called the "standard solution of 16 degrees of hardness." Good London curd soap is dissolved in proof spirit, in the proportion of one ounce of avoirdupois for every gallon of spirit; and the solution is filtered into a well-stoppered phial, capable of holding 2,000 grains of distilled water; 100 test measures, each measure equal to 10 water-grain measures of the standard solution of 16 degrees of hardness, are introduced. Into the water in this phial the soap solution is gradually poured from a graduated burette; the mixture being well shaken after each addition of the solution of soap, until a lather is formed of sufficient consistence to remain for five minutes all over the surface of the water, when the phial is placed on its side. The number of measures of soap solution is noticed, and the strength of the solution is altered, if necessary, by a further addition of either soap or spirit, until exactly 32 measures of the liquid are required for 100 measures of the water of 16 degrees of hardness. The experiment is made a second and a third time, in order to leave no doubt as to the strength of the soap solution, and then a large quantity of the test may be prepared; for which purpose Dr. Clarke recommends to scrape off the soap into shavings, by a straight, sharp edge of glass, and to dissolve it by heat in part of the proof spirit, mixing the solution thus formed with the rest of the proof spirit.

Process for ascertaining the Hardness of Water.—Previous to applying the soap test, it is necessary to expel from the water the excess of carbonic acid—that is, the excess over and above what is necessary to form alkaline or earthly bicarbonates, this excess having the property of slowly decomposing

a lather once formed. For this purpose, before measuring out the water for trial, it should be shaken briskly in a stoppered glass bottle half-filled with it, sucking out the air from the bottle at intervals by means of a glass tube, so as to change the atmosphere in the bottle; 100 measures of the water are then introduced into the stoppered phial, and treated with the soap test, the carbonic acid eliminated being sucked out from time to time from the upper part of the bottle. The hardness of the water is then inferred directly from the number of measures of soap solution employed, by reference to the subjoined table. In trials of waters above 16 degrees hardness, 100 measures of distilled water should be added, and 60 measures of the soap test dropped into the mixture, provided a lather is not formed previously. If, at 60 test measures of soap test, or at any number of such measures between 32 degrees and 60 degrees, the proper lather be produced, then a final trial may be made in the following manner:—100 test measures of the water under trial are mixed with 100 measures of distilled water, well agitated, and the carbonic acid sucked out; to this mixture soap test is added until the lather is produced, the number of test measures required is divided by 2, and the double of such degree will be the hardness of the water. For example, suppose half the soap test that has been required correspond to $10\frac{5}{10}$ degrees of hardness, then the hardness of the water under trial will be 21. Suppose, however, that 60 measures of the soap test have failed to produce a lather, then another 100 measures of distilled water are added, and the preliminary trial made, until 90 test measures of soap solution have been added. Should a lather now be produced, a final trial is made by adding to 100 test measures of the water to be tried 200 test measures of distilled water, and the quantity of soap test required is divided by 3; and the degree of hardness corresponding with the third part being ascertained by comparison with the standard solutions, this degree multiplied by 3 will be the hardness of the water. Thus, suppose 85.5 measures of soap solution were required $8\frac{5}{10} \times 3 = 28.5$, and on referring to the table this number is found to correspond to 14 degrees, which, multiplied by 3, gives 42 degrees for the actual hardness of the water.

Table of soap test measures corresponding to 100 test measures of each standard solution:—

Degree of Hardness.	Soap Test Measures.			Differences as for the next Degree of Hardness.		
0	.	.	1.4	.	.	
1	.	.	3.2	.	.	1.8
2	.	.	5.4	.	.	2.2
3	.	.	7.6	.	.	2.2
4	.	.	9.6	.	.	2.0
5	.	.	11.6	.	.	2.0
6	.	.	13.6	.	.	2.0
7	.	.	15.6	.	.	2.0
8	.	.	17.5	.	.	1.9
9	.	.	19.4	.	.	1.9
10	.	.	21.3	.	.	1.9
11	.	.	23.1	.	.	1.8
12	.	.	24.9	.	.	1.8
13	.	.	26.7	.	.	1.8
14	.	.	28.5	.	.	1.8
15	.	.	30.3	.	.	1.8
16	.	.	32.0	.	.	1.7

The water supplies of many of the large cities are derived from lakes and rivers dammed up. These are, in general, situated in thinly-peopled districts, where the waters are not liable to be tainted with sewage impurities. With few exceptions, the new water supplies contain very little solid matter in solution, whilst

the water formerly in use was, as a general rule, *hard*—that is, it contained from ten to seventy grains of solid matters per gallon. When the bills for the better supplying of Manchester, Glasgow, Dublin, and other towns with water were before Parliament, the medical and scientific evidence adduced was nearly altogether in favour of soft water as against hard water. It was to a great extent on the faith of this evidence that Parliament was induced to sanction the expenditure of several millions of pounds for the construction of water works. After all this, it is rather startling to find a high sanitary authority—Dr. Letheby, medical officer of health for the city of London—stating that the use of soft water in a town greatly increases the mortality of its inhabitants. In his report on the sanitary condition of London during the year 1869 he gives a table showing the average composition of the water supplied to the metropolis during the year, and from which we learn that the proportion of solid matter per gallon varied from 18.18 to 27.85 grains. The solid matter consisted chiefly of lime salts, which Dr. Letheby contends render the water wholesome. He says:—

“In this country it is remarkable that wherever soft water is supplied to the people the mortality is large, even when allowance is made for the birth-rate of the place. Glasgow, for example, as well as Preston, Dundee, Sheffield, Plymouth, Manchester, Bradford, &c., which are all supplied with water of less than four degrees of hardness, have a mortality which ranges from 26 to 34 per 1,000; while at Birmingham, Bristol, Sunderland, Newcastle-on-Tyne, Wakefield, Dover, Norwich, Croydon, Worcester, Derby, and other places where the waters are hard, the mortality is considerably less—in fact, it may be said that in towns supplied with water of more than ten degrees, the average mortality is about 22 per 1,000; while in those supplied with softer water it is about 26 per 1,000.”

Dr. Letheby states that the *savans* appointed by the authorities of Paris and Vienna to decide on the quality of the water to be supplied to those cities reported in favour of water of moderate degrees of hardness. One consideration seems to have powerfully influenced the decision of the French *savans*—namely, the allegation that more conscripts are rejected in the soft water districts, on account of imperfect development and stunted growth, than in the hard. “And if,” says Dr. Letheby,

“We regard the subject from another point of view, there is the striking fact that, as three-fourths of the earth's surface is covered with calcareous strata, we are compelled to drink calcareous water, as if it were intended for a wholesome purpose; and it may well be, as the late Professor Johnson observed, that ‘the bright sparkling hard waters which gush out in frequent springs from our chalk and other limestone rocks are relished to drink, not merely because they are grateful to the eye, but because there is something exhilarating in the excess of carbonic acid they contain, and give off as they pass

through the warm mouth and throat; and because the lime they hold in solution removes acid matters from the stomach, and thus acts as a grateful medicine to the system. To abandon the use of such a water, and to drink daily in its stead one entirely free from mineral matter, so far from improving the health, may injure it. In fact, the water of a country may determine the diet of its inhabitants. The soft water of the lakes of Scotland, for instance, may have had much to do with the use of brown meal; and but for the calcareous waters of Ireland the potato could not have become a national food. Looking, therefore, at the plain teachings of all this, and considering the excellent quality of the water supplied to this metropolis, it would be folly, in my opinion, to change it for a soft water."

The citizens of Dublin have recently expended nearly half a million sterling in supplying themselves with water of about two degrees of hardness, instead of the water of from fifteen to twenty-two degrees of hardness formerly in use in that city. If Dr. Letheby's view be correct, the inhabitants of Dublin may justly complain that, acting upon the advice of scientific men, they have been led to worse than useless extravagance. It seems, however, strange that the use of pure soft water could be the means of largely increasing the death-rate of a town. The ordinary food which we use contains abundance of mineral substances, with which the bony structures of the body are nourished. Even if it did not, the quantity of useful earthy matter taken into the body through the medium of water would be inadequate to subserve any useful purpose. Let us take the case of an average sample of the hard water supplied to London. It contains 16 grains of earthy salts per imperial gallon (70,000 grains weight, or 160 ounces). Few persons drink more than half a gallon of water per day, so that a person consuming that large quantity would derive from it only eight grains of earthy salts. It must be borne in mind, too, that by heating water, the hardness of which is due to the presence of calcic carbonate, a large proportion of the earthy salt is rendered insoluble. Much of the lime contained in the hard water used for domestic purposes is deposited in the tea kettles and other appliances of the household. The quantity of lime in a man of 160 lbs. weight is about one pound, and an adult daily consumes in his food at least $\frac{1}{4}$ oz. of earthy salts. As the lime contained in the bones is associated nearly altogether with phosphoric acid, and *not* with carbonic acid, it is evident that the chalk contained in hard waters cannot contribute, at least in an important manner, to the nutrition of the body.

The apparent relation between the death rate and the nature of the water supplies in the towns mentioned by Dr. Letheby is certainly remarkable; but I think the death rates in Glasgow, Manchester, and the other towns supplied with soft water was not lower when the water furnished to them was hard. Dr. Letheby includes Dublin amongst the towns which have a very high death

rate ; and yet, until very recently, that city was supplied with water of about the degree of hardness which Dr. Letheby considers most desirable. So far as my observation extends, I am clearly of opinion that the substitution of the pure soft water of the Vartry for the hard water supplied by the canals has produced an improvement in the public health.

I have received a letter upon this subject from Dr. Gairdner, late medical officer of health for the city of Glasgow, and author of an excellent work on air and water, from which I quote the following extract :—

“The highlanders and islanders of Scotland, who, despite many unfavourable circumstances, enjoy the credit of a low death-rate, almost all drink soft water ; and I do not know a single fact showing that soft water, in the many instances in which it has now been brought into populous places, instead of hard, has in any instance led to an increased death-rate, or produced an appreciable bad effect where the other sanitary circumstances are good.

“In Glasgow the whole of the west end, well-to-do population drink Loch Katrine water, and do not suffer. The death-rate of the town is affected by quite other causes.”

Papers have been written by Dr. Murray, of Newcastle, Dr. Cadge, of Norwich, and others, to prove that hard waters give rise to calculi in those who drink it habitually. In Norfolk calculous disease is common, and the waters in that county are very calcareous. Professor Gamgee states that sheep are very liable to calculi in the limestone districts. If calculous disease resulted from the use of hard water, then it should be very prevalent in Ireland ; but such is not the case.

CHAPTER VIII.

BAD WATER A CAUSE AND CARRIER OF DISEASE.

The majority of sanitarians are of opinion that foul water is a common carrier of contagious diseases—of, at least, two of them, namely, typhoid fever and Asiatic cholera. It undoubtedly is the direct cause of non-contagious maladies such as simple diarrhœa and constipation; and not unfrequently it introduces entozoa into the bodies of men and the lower animals. Dr. Buchanan¹ believes that cholera and enteric fever are communicated chiefly through the medium of polluted water. Pettenkofer states that when the soil water is lowered the cholera poison diffuses itself throughout the porous soil; but, according to Buchanan, when the soil water subsides, the superficial wells become more impure from effete animal matters, and the drinking water which they supply is the direct carrier of the disease. It is evident that when the soil water is nearly up to the surface of the ground the waste matters thrown out from dwellings are carried off horizontally by the drainage; whilst, when the soil water is low, the refuse sinks into the surface wells, which thereby become polluted, and during epidemics of cholera, or endemics of enteric fever, retain the virus of those diseases. Dr. Buchanan quoted several facts to prove that typhoid fever is spread by means of polluted potable water; and he endeavours to prove that the subsidence of soil water does not affect the spread of the disease in localities supplied with water brought from pure and remote sources. I quite agree with Dr. Buchanan in regarding impure drinkable water as a common vehicle in which the germs of several zymotic diseases are carried into the body. During the last epidemic of cholera in Ireland I found that the pump water used in several localities where the disease was unusually severe contained excessive amounts of animal impurities. This was particularly the case with Arklow and Mallow. In the latter town there were few cases of the disease except in one suburb, the well water of which I found loaded with organic matter, nitrates, and nitrites. Where the disease did not prevail the water was remarkably pure. Dr. Buchanan's views are greatly strengthened by the facts set forth in Ballot's report on the spread of cholera in Holland; for that author has shown that in every town in the Netherlands where rain water alone was drunk there were either no cases of cholera or a few isolated ones. On the other hand, where wells and canals furnished the water of towns or villages, the disease prevailed. Pettenkofer himself does not deny the fact that cholera and typhoid fever are occasionally contracted by drinking impure water. In November, 1869, I had the pleasure of conversing

¹ Medical Times and Gazette, March 12th, 1870.

with Professor Pettenkofer upon this and other subjects, and he stated that he believed cholera was occasionally communicated through the agency of potable water, but that the general spread of the disease was not through that channel.

Dr. Bryden, of the Bengal army, has published a voluminous report on the outbreak of cholera in Northern India in 1866-68. Some of the facts mentioned in this report are strongly in favour of the theory of the general propagation of cholera by means of impure water. Whilst the water-tanks are fouled by dipping clothes into them and bathing in them, and the supplies are drying up, the disease increases rapidly; but when the tanks are cleaned out and refilled with pure rain water the cholera vanishes, and does not reappear during the time that rain keeps the tanks full of water.

The history of the last epidemic of cholera in Europe appears to me to prove clearly that cholera is very frequently communicated through the medium of potable water. Letheby doubts that water had much to do with the spread of cholera in London during the late outbreak, but the great majority of health officers of the metropolis hold an opposite opinion. In an elaborate report, prepared by Dr. A. M. Ballot, of Rotterdam, voluminous evidence is produced to prove that cholera was propagated throughout Holland chiefly by means of polluted water. Dr. Ballot's conclusions are as follows:—

1. Our country is highly affected by the cholera at every epidemic, chiefly in those parts where they drink water directly from the rivers and canals, or from the ground saturated with sewerage matters.

2. In places where rain water is generally drunk the disease is by far less violent.

3. Places where there is no other drinkable water but rain water are not affected by the epidemic: the single cases occurring there are imported.

4. When places affected by the cholera were supplied with pure water instead of the vitiated water the disease disappeared.

The use of ordinary hard water probably predisposes persons to contract cholera when the disease is prevalent; but water containing the actual virus of cholera is, of course, that by means of which the disease is chiefly propagated.

In the "Second Annual Report of the State Board of Health of Massachusetts, January, 1871," the subject of the causes of typhoid fever is treated at considerable length. Inquiries were made from medical men in 163 towns of the State, and their replies occupy sixty pages of a large volume. The following is a tabulated statement of the leading queries and their answers:—

1. Have you observed a difference in the prevalence of this disease between houses supplied with water from wells about the premises and houses supplied with water conveyed from springs or from ponds of unquestionable purity?

Replies.

Yes,	.	.	.	23
No difference has been remarked,	.	.	.	71
Whole supply of town from wells,	.	.	.	18
Indefinite,	.	.	.	51

2. Can you inform us whether, at times when typhoid prevailed, the water of the wells was rising or falling, and whether it was higher or lower, than the average for the year?

(If your attention has not been given to the height of subsoil water as marked by the wells, will you have the kindness to note it in future epidemics, and let us know the result?)

Replies.

Rising after being very low,	.	.	11
Falling,	.	.	16
Very low,	.	.	36
Have not observed,	.	.	100

3. Have you observed any connection between typhoid fever and foul soil, whether from privies, pigsties, manure heaps, or similar collections of decomposing matter lying on the ground?

Replies.

Yes,	.	.	.	79
No,	.	.	.	45
Doubtful,	.	.	.	39

4. Have you observed any connection between typhoid fever and putrid air, whether from rotting vegetables in cellars, bad drains, unventilated living or sleeping rooms, or from any other cause?

Replies.

Yes,	.	.	.	90
No,	.	.	.	36
Doubtful,	.	.	.	37

Ten towns report that typhoid fever is a disease almost unknown among them, and for this reason they can give no information.

THE MORTALITY FROM TYPHOID FEVER IN THE URBAN POPULATION OF MASSACHUSETTS DURING THE LAST TEN YEARS.

	Population 1865 (All Ages).	Total Deaths from Typhoid in Ten Years.	Average No. of persons living each year to one Death.	Average No. of Deaths each year to 1,000 Persons living.
One hundred and forty-seven (147) cities and towns of more than 2,000 inhabitants,	1,044,294	7,888	1,323·90	0·755
One hundred and eighty-four (184) towns of less than 2,000 inhabitants,	213,468	2,539	840·75	1·189

It appears that typhoid fever is more prevalent in the small towns in the rural districts than in the densely populated centres of manufacturing industries, although the death-rate from all causes is higher in the latter. This fact bears out to some extent the statement lately made by Dr. Stark, of Edinburgh, that the zymotics are, relatively to the number of deaths, as destructive in the country as in towns. They do not, however, sustain the theory put forth by Dr. Stark that the extirpation of zymotic diseases is beyond the power of man. It is shown in the Reports upon this

subject presented to the Massachusetts Board of Health that the common proximate cause of typhoid fever in that State is organized matter (chiefly vegetable) in a state of decomposition. "Whether the vehicle be drinking water made foul by human excrement, sink drains, or soiled clothing; or air made foul in enclosed places by drains, decaying vegetables, or fish (Swampscott), or old timber (Tisbury), or in open places by pigsties, drained ponds or reservoirs, stagnant water, accumulations of filth of every sort, the one thing present in all these circumstances is *decomposition*."

If decomposing organic matter be then the proximate cause of typhoid, sanitary measures might be rendered as efficacious in the abatement of this disease in villages and the open country as in the most densely crowded towns.

Those who believe that impure potable water has but little to do with the spread of the malady contend that it is the foul air issuing from the soil, and not from the water, that conveys the typhoid contagium. No outbreak of the disease can occur until the soil is typhoid ripe. The most dangerous condition of the soil is when the ground water is sinking after a previous rise. In Massachusetts it would appear that the period during which typhoid fever is prevalent coincides with that in which the water is lowest in the wells. The editor of the reports on typhoid fever in the Report of the Board of Health suggests that the comparative immunity from this disease enjoyed by the denizens of the larger cities may be due to the pavement and other impervious layers which cover the soil. If emanations from the soil be the source of the disease, the safest plan is to sleep in the highest stories of our houses. As for cellars and kitchens, the authorities should prohibit their use as sleeping apartments.

On studying carefully the literature of cholera and typhoid fever, I have come to the conclusion that the evidence in favour of the view that the disease is largely spread by polluted water is conclusive.

Dr. W. B. Richardson, of Dublin, requested me to examine a well water which had been used by a large family in Kingstown, nearly all of whom had been attacked with typhoid, which in several cases proved fatal. The water was very bad, and contained albuminoid and ammoniacal nitrogen in very large quantities. It was subsequently found that the pipe from the water closet discharged its contents into a *cul de sac* situated within a yard of the well.

Typhoid fever broke out some time ago in two of the departments of the staff of the Board of National Education. On examining the water used by the persons affected, I found it highly impregnated with sewage impurities. Since the introduction of the pure water of the Vartry for the foul pump water previously used in these departments no further cases of typhoid have occurred.

It is believed by many epidemiologists that water polluted with the excretæ of healthy persons is capable of producing

typhoid; but if that be the case, this disease is not a true zymotic, like small-pox or scarlatina.

If such polluted water were capable of propagating cholera, it is strange that the disease is not more common, seeing potable waters of this country are so generally contaminated with sewage. I have known whole families to use for years well waters largely impregnated with sewage, and yet typhoid never appeared amongst them, and I have frequently met with cases where the water used by families was very bad, and yet produced no serious disease until there was the strongest proof that the dejections of a typhoid patient had entered. I could cite numerous cases of this kind, but one will serve as an illustration. A person went on a visit to the family of an official of the Corporation of Dublin, and immediately was stricken down with typhoid, the incubatory stage of which disease must have been going on for some time previous to his arrival. Though isolated from the family, the disease in due time appeared amongst them, in what appeared to be an unaccountable manner. I examined the well water used by the family, and found it loaded with animal impurities. A direct connection between the shaft of the well and the house sewer was soon after discovered, and the mode in which the typhoid poison had been propagated explained. If decomposing animal matter is capable of giving rise to typhoid, it is certainly strange that it did not cause an outbreak in the case above described; for the foul water had long been in use, and the connection between the well and the sewer was of long standing.

There is not sufficient evidence to show that other zymotic diseases than cholera and typhoid are propagated through the medium of foul water; but as scarlatina has been spread (as will be shown further on) by polluted milk, it is not unlikely that it may be communicated by means of water.

Goitre and cretinism are often attributed to the use of certain kinds of water, but the nature of the impurity in water, or whether or not it is due to the absence of some mineral ingredient, are still debated points. The presence of large quantities of magnesian salts, of lime compounds, of fluorine, of copper, and other heavy metals, and of large amounts of vegetable organic matter, has been by different writers assigned a goitre-producing faculty. If earthy salts produce goitre, then the disease ought to be very common in Ireland, which is not the case, because Irish well water contains very large quantities of magnesian and calcareous salts. The want of iodine in Swiss waters is said to be the cause of much of the goitrous disease met with in Switzerland, but there is really no sufficient data for such a hypothesis. Whilst the cause or causes which produce goitre are almost unknown, there is a wonderful concordance of opinion amongst medical writers from the earliest to the present time in attributing to water the production of this disease.

Various species of worms, such as *Ascaris lumbricoides* (round worm), *Strongylus duodenalis*, and *Filaria dracunculus* (guinea worm), are believed to enter the body through the medium of water.

The family of the late King Louis Philippe, whilst residing at Claremont, suffered from symptoms of lead poisoning, produced by the use of water containing 7-10th of a grain per gallon of lead. According to Dr. Angus Smith, one-fourth of a grain per gallon is sometimes sufficient to affect persons peculiarly susceptible to the influence of this poison. Several cases of chronic poisoning by lead-impregnated water have come under my observation.

In the Second Annual Report of the Massachusetts Board of Health there is a paper on the subject of poisoning by water containing minute traces of lead. The following query was addressed to a number of persons in different towns :—

“Have any cases of lead colic or lead paralysis occurred in your town or district, in which you have been able to trace the origin of the disease to water pipes?”

“The replies are from one hundred and seventy correspondents, in as many different places, and are as follows :—

Yes,	41
No,	101
Doubt expressed,	20
No lead used in the town,	8

“It is stated that in certain towns lead pipe is only used to convey water from springs, and that, when allowed to flow continually without plugs or stop-cocks, no harm has been known to follow.

“The negative replies are very brief, and may be construed as meaning generally that no bad effects have been observed, rather than that, in the opinion of the writers, none may occur from the contact of drinking water and metallic lead.

“The affirmative replies are direct and positive, and are usually accompanied by evidence. They occasionally refer to other accidental modes of poisoning by lead, as by hair dyes, which are almost universally composed of acetate of lead and sulphur in various proportions; also by cider and vinegar drawn through lead faucets.”

Soft water containing much organic matter, nitrates, and gases act most readily upon lead; hard water least. Hard water containing chlorides may act slightly upon lead, those rich in sulphates come next, and those which hardly, if at all, attack the metal are waters rich in carbonates. The Dublin pipe water is soft, but I find that it does not sensibly act upon an alloy of 96·5 parts of lead and 3·5 parts of tin. The water of Edinburgh is said to contain 1-140th grain of lead per gallon; but no bad effects have been attributed to the use of that water.

Add a little acetic acid and ammonium acetate to $\frac{1}{2}$ gallon of water, concentrate it to 2 ounces, and add solution of sulphuretted hydrogen. A dark precipitate or colour indicates lead or copper. Collect the precipitate, place on charcoal, and with the blowpipe flame reduce the metal from it. Dissolve the metal in nitric acid, and to neutral solution add iodide of potassium, which produces yellow iodide of lead. Copper, mercury, zinc, and arsenic rarely occur in water.

CHAPTER IX.

QUALITY OF THE WATER USED IN IRISH TOWNS.

The quality of the water used in the majority of Irish towns and villages is bad—sometimes *very* bad. The “parish pump” collects not only the rain-water which falls on the catchment basin of the district, but also no inconsiderable amount of the liquid refuse thrown out from houses and stables. Many of the landed proprietors of Ireland are engaged in the meritorious work of providing decent dwellings for the labourers on their estates; some of these benevolent persons would, no doubt, procure or aid in obtaining supplies of good water for the use of the villages on their properties were their attention directed to the subject. Lord Annally has recently so supplied, to some extent, the tenants on his Clare estates. The water used for this purpose is of good quality, containing very minute quantities of nitrogen compounds. The municipal authorities of towns and the Boards of Guardians have now full power to provide pure and ample supplies of water for their respective districts.

Dublin.—The capital and its suburbs are supplied with high-pressure water, conveyed from a reservoir formed by damming up the Vartry river. The reservoir is situated on an elevated granitic district of the county of Wicklow, twenty-three miles distant from the city; it is capable of supplying thirty-five gallons per diem per head of the population of the city and its suburbs. The water contains $4\frac{1}{2}$ grains of solids per gallon, of which $2\frac{1}{2}$ grains consist of substances volatilizable at a red heat. Its albuminoid nitrogen is sometimes as low as 0.002 grain per gallon, and its ammonia seldom exceeds 0.001 grain per gallon. It contains, occasionally, very minute traces of nitrous and nitric acids, evidently the products of the oxidation of vegetable matter. The Vartry water is pure and wholesome, and no one should now use the pump water of the city, which is often very polluted. I shall give but one example of a Dublin pump (but all are, fortunately, not so bad).

COMPOSITION OF THE WATER FROM THE PUMP AT THE HORSE POLICE BARRACKS, KEVIN-STREET.

One gallon contains :—

Fixed mineral matters,	109.03 grains.
Organic and volatile matters,	42.50 „

Total solids,	151.53 „
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Large quantities of nitrogen compounds, chlorine, and gypsum present.

Waterford.—It is hardly possible to find a town so badly supplied with water, both with respect to quality and quantity, as Waterford. The Corporation own considerable property, and the taxation is, consequently, very light; yet a large number of the citizens object to the expense necessary to the procurement of a

good water supply. The Corporation, some years ago, obtained an Act of Parliament for the purpose of introducing pure water into the city, and it is to be hoped that the Act may not, like so many other well-intended measures, be allowed to remain a dead letter.

Waterford is, to a great extent, dependant upon its own wells for its water. About fifty of these well waters have, from time to time, been submitted to me for analysis by the Corporation, and, with few exceptions, I found them highly contaminated with animal matter and the products of its decomposition. One of these, which appears to have been in great demand, was, without exception, the worst water that ever came under my notice by observation or reading. A gallon of it contained :—

Solid matters,	...	...	...	...	70.10 grains.
Including :—					
Albuminoid nitrogen,	...	...	...	...	0.40 "
Ammonia, ...	...	...	...	...	4.06 "
Sulphate of calcium,	...	...	...	...	30.20 "
Chlorine, ...	...	...	...	...	15.00 "

Besides considerable quantities of nitrites and nitrates.

On closely smelling this water a faint urinous odour was observed. The chlorine existed chiefly in combination with calcium and magnesium; and although the "solids" were so abundant, they did not include carbonate of calcium. The amount of ammonia in this water greatly exceeded the quantity which I found in some specimens of Dublin sewage.

Another specimen of Waterford pump water contained 385.8 grains (nearly an ounce) of solids per gallon, including 0.4 grain of albuminoid nitrogen, 1.5 grain of ammonia, 34 grains of gypsum, and 76 grains of chloride of sodium. I found in another well-water 171.9 grains of solids per gallon, including 0.5 grain ammonia, 0.25 grain albuminoid nitrogen, 105 grains of earthy sulphates, and 38 grains of chlorine.

The *Waterford News*, May 16th, 1873, thus describes the deficiencies in the city water-supply :—

THE RESERVOIRS.—At present the four reservoirs of the city are fairly supplied with water, though, as the season advances, it will gradually diminish to a very low ebb. In short, the daily supply to houses taking pipe-water must be cut off to three or four days in the week, or even less. There are not 400 out of 4,000 houses taking this water. There is no more to give. The Corporation have to refuse applications to supply other houses with pipe-water. Three of the reservoirs are closely surrounded by bacon cellars, as also by cabins and yards of the foulest class.

THE PUMPS.—The waters from the following pumps were found not available for cooking purposes. Two in Ballybricken Green—one in the Mayor's Walk—one in the Glen—one in Johnstown—one on Thomas's-hill—one in Little Patrick-street. In fact, the inhabitants pronounced the waters from all the pumps as too hard for the uses of the kitchen. In this they exactly agree with the analysis of Dr. Cameron.

THE CONDUITS.—The waters from the conduits come under the same head. The two conduits on the quay (at the clock-tower and market-house) are only used for all kinds of cattle. The conduit in John-street runs dry

every summer, and the conduit in New-street is especially objectionable, as it is supplied from a well under the floor of a dwelling-house, adjoining which is a rag-and-bone yard, which, though kept very clean for such a place, does not smell the sweetest. Several persons may be seen waiting for their turn at these and other conduits every hour in the day.

THE SEWERS.—The Committee observed the mouths of the street sewers and lanes more or less filled with dry clay, dust, straw, and other rubbish, emitting foul odours, which must, of course, engender disease. In dry weather all the sewers are no use, for want of water to flush them.

THE POOR SUFFERING MOST.—When the sewers and water supplies are in this state now, what will they be in two months hence—say in August? It is not necessary to make provision for a water supply in winter, when it can be had from the roof of every house. It is the working classes who suffer most in this city for want of water, and those are the persons who are now afflicted here with fever; but who can say they will escape when it finds a lurking abode amongst undrained and dirty places? None of the present pipe-water reaches the poor—their only resources are the pumps. There are over 3,600 dwelling-houses in the city without any supply. A medical officer told us some time ago that he has known a whole family to wash themselves in a vessel containing the same water, so scarce was it at the time. There is not a drop of pipe-water in the whole district of Ballybriken, the most populous portion of Waterford. There is but one pump to give water to a dense population around Patrick's Chapel; this pump is situate in ground which cannot be free from impurities; the water is, therefore, bad. The inhabitants must go to Alexander-street for water for drinking purposes, &c.

I need hardly add that the state of the public health in Waterford is unsatisfactory, and the death-rate occasionally is extremely high. In 1873 it amounted to 31·7, the highest in any Irish town. Dr. Delandre, one of the Dispensary physicians, found in an outbreak of typhoid in 1873 that every patient had used the water from a pump which I subsequently found to be highly impure.

Limerick.—This city is supplied with both river and pump water. The river (Shannon) is tolerably good, but not up to the full standard of purity requisite for a town supply. Some of the wells contain 100 grains of solid matters per gallon, and are otherwise very impure. Of the score of Limerick waters which I have examined only about five were decidedly good.

Kilkenny.—Nearly fifty specimens of well waters used in this city have been sent to me for analysis, chiefly by the Corporation. Most of them contained from 50 to 100 grains of solids per gallon. The most striking feature of Kilkenny waters is the immense quantities of nitric acid which they contain, and a portion of which, no doubt, is derived from the fossiliferous limestone of the district, and not from sewage. Still, these waters, taken altogether are very bad, and utterly unfit for drinking, cooking, or washing. Pure water exists in sufficient quantity at no great distance from the city, and it is to be hoped that the Corporation will soon seriously set about obtaining an adequate supply of this indispensable liquid.

Drogheda.—I have recently analysed for the Corporation of Drogheda ten specimens of the pump waters used in that city. The solids per gallon varied from 12·34 to 105·2 grains per gallon, the earthy sulphates from a trace to 45 grains, and the chlorine

from a trace to 12·2. On the whole, the amount of nitrogen compounds was too large; two of the waters were very bad. "North-road pump" contained 102·2 grains of solids, 0·25 grains of ammonia, 0·112 grains albuminoid nitrogen, 25 grains of sulphates, and 9·8 grains of chlorine per gallon. "West-gate pump," "Magdalanestreet fountain," and "Marito pump" contained excessive amounts of nitrogen compounds. The "Bachelors'-lane pump" was free from sewage, but contained 105 grains of solids per gallon. The other waters were tolerably good. Drogheda is also supplied with pipe-water, brought from a distance by a company. This water is sometimes dark-coloured, but I have not detected sewage in it. It should be used in preference to the pump water; but the Company should see that it is properly filtered.

Banbridge (Co. Down).—Nineteen pump-waters used in this town were, in 1874, sent to me for examination by the Town Commissioners. The solids, with two exceptions, varied from 13·34 to 34·78 grains per gallon—the exceptions contained 91·97 and 83·33 grains, respectively, per gallon. Nearly all contained very large quantities of nitrates and nitrites, which, taking into account the comparatively small amounts of earthy salts, indicated that the waters had polluted sources. The amounts of ammonia in six of these waters exceeded 0·2 grains per gallon. There was not one really good water amongst the nineteen specimens!

Millstreet (County Cork).—Two pump waters examined for the Board of Guardians proved extraordinarily pure. The solids amounted to only 3·16 and 5·63 grains per gallon respectively.

Enniskillen.—I have only examined six specimens of pump water, two were of indifferent and four of very bad quality. The latter contained 89·04 grains of solids (including a considerable amount of nitrogen compounds) per gallon.

Wicklow.—The composition of the waters in use in this town is variable. Near the sea the solids are greatly increased by common salt. In the inner parts of the town the solids in the water vary from 14 to 47 grains per gallon. As a rule, the town water is impure, but a good supply is being obtained from a situation some distance from the town.

Gort (County Galway).—I have examined four waters used in Gort. That from a river contained 8·49 grains of solids, a trace of nitrous acid, and traces only of other nitrogen compounds. The others were pump waters, containing from 36 to 70 grains of solids per gallon—one being of bad and two of good quality.

Westport (County Mayo).—Three waters used in this town which I examined proved of fair quality.

Carrickmacross.—Of three waters from this town which I examined some years ago, two were bad.

Tralee (County Kerry).—I have examined nearly a score of well waters used in or near this town. I found most of them contaminated with sewage impurities; one very impure water contained 201·77 grains of solids per gallon, and included large

amounts of nitrogen compounds. Some of the waters used in this town are pure. One in particular contained, I found, 26·7 grains of solids per gallon, was free from gypsum and chlorine, and contained the merest traces of nitrogen compounds.

Cavan.—I have examined only two specimens of water used in this town. "Farnham-street pump" contained 83·13 grains of solids per gallon, including albuminoid nitrogen, 0·018; ammonia, 0·18; earthy sulphates, 14·9; chlorine, 4·18. The Court-house pump proved to be good.

Maryborough (Queen's County).—The eight specimens of water used in this town which I have examined afforded about an equal number of bad and good specimens. That furnished by the pump in the Court-house was very bad at the date of my examination. The waters in this district are very hard.

Naas (County Kildare).—Ten of the well waters used in or near this town have been examined by me. The solids per gallon varied from 25 to 64 grains per gallon. The nitrogen was chiefly in the form of nitric acid; none of them contained large amounts of ammonia, &c. Some of the waters were, however, of decidedly bad quality.

Listowel (County Kerry).—Twelve specimens of waters used in this town and district have been submitted to me for analysis by the Board of Guardians. The solids varied from 4·5 to 308·64 grains of solids per gallon. Most of them were perfectly free from sewage impurities, and, on the whole, their quality—except in the case of one very hard water—was good.

Kenmare (County Kerry).—Six samples used in or near the town gave, on the whole, good analytical results. The water was slightly impregnated with peaty matters.

Carrick-on-Suir (County Tipperary).—The four waters sent from this contained no sewage impurities. Two were hard and the others somewhat soft.

Carlow.—I have only examined two of the public wells in this town. These waters were pretty free from organic impurities: their solids per gallon were respectively 66 and 43·21 grains.

Athy (County Kildare).—About a score of the well waters of this town have been submitted to me for examination. Their solids per gallon varied from 20 to 80 grains. About one-third were of good, one-third of very bad, and one-third of indifferent quality. Nitrates were not abundant in these waters.

Callan (Co. Kilkenny).—The waters of three pumps I found to contain, respectively, 82·2, 5·55, and 49 grains of solids per gallon. The only nitrogen compound present in one of them was nitrous acid; the others were free from sewage impurities.

Downpatrick.—I examined two pump waters from this town—one from the Lunatic Asylum, the other from a public school. The former contained 16 grains per gallon, the latter 86 grains; both were free from sewage.

Queenstown (Co. Cork).—I examined, in July, 1874, the waters

of three of the public pumps in that town sent to me by the Town Commissioners. The solids in each were, respectively, 16·4, 17, and 22 grains per gallon. Two were free from sensible amounts of impurity; the other (that which contained 22 grains of solids) was impure.

Kingstown (Co. Dublin).—I have found many of the pump waters in this town in a highly impure condition. The solids, per gallon, amounted to from 70 to 150 grains—nearly all earthy salts. The town is supplied with excellent pipe water from the Vartry; but some of the inhabitants still persist in drinking the foul water furnished by the private wells.

Dalkey (Co. Dublin).—I found in the pump water of this town enormous amounts of nitrates and nitrites. One specimen, submitted to me by Dr. Tuffnell, now President of the Royal College of Surgeons, contained 77·25 grains of solids per gallon, of which 22·06 consisted of organic and volatile substances. There were at least 10 grains of nitric acid in the water. Here we have the case of a well water in a granite district which, were there no inhabitants in the place, would not probably contain more than 5 or 6 grains of solids per gallon, highly contaminated, and devoid of the characteristics of water from the igneous rock formations. Dalkey has, quite recently, been supplied with Vartry water.

Parsonstown.—I have not examined any of the public well waters used in this town; but if they resemble the water from two private pumps recently examined by me, they must be very impure. These contained large quantities of nitrogen, and 37·03 and 111·15 grains of solids each per gallon.

Longford.—The waters in this town are only of an indifferent quality. The Town Commissioners are at present considering schemes for introducing a good supply. The waters in the locality are generally of a very brown hue; but their freedom from chlorine shows that the colour is due to vegetable and not animal impurities.

Castle Daly (Westmeath).—Three waters from this place, which I examined in 1872, had the following remarkable compositions. One gallon of each contained:—

	No. 1.	No. 2.	No. 3.
	Grains.	Grains.	Grains.
Fixed solids, ...	7·05	13·70	16·48
Organic and volatile matters, ...	18·80	10·02	9·98
Total solids, ...	25·85	23·72	26·46

These waters were free from chlorine, and the enormous amounts of organic matter were derived from peat. They were, of course, unfit for use.

Belfast.—Dr. Hodges, analyst for Belfast, informs me that the pipe water of Belfast contains 11·2 grains of solids per gallon,

Relation between Death-rate and Water Supply. 93

including albuminoid nitrogen 0·009 grain ; ammonia 0·001 grain, and chlorine equal to 1·7 grain of common salt.

Cork.—Mr. O'Keeffe, analyst for Cork, has favoured me with the following analysis of the Lee water with which that city is supplied. A gallon contains :—

Solid Matters ...	...	...	...	5·570 grains.
Including				
Albuminoid Nitrogen	...	...	...	0·075 „
Ammonia	...	...	...	0·040 „
Chlorine	...	...	...	0·661 „

These results show that Cork pipe water is very impure.

POPULATION, NUMBER OF DEATHS, AND RATE OF MORTALITY IN THE REGISTRARS' DISTRICTS REFERRED TO ABOVE:—

Registrars' Districts.	Population in 1871.	Number of deaths Registered in 1873.	Rate of Mortality per 1,000 Inhabitants.	Registrars' Districts.	Population in 1871.	Number of deaths Registered in 1873.	Rate of Mortality per 1,000 Inhabitants.
Athy	8,256	230	27·9	Kenmare	4,719	124	26·3
Banbridge	20,895	310	14·8	Kilkenny	17,311	420	24·3
Belfast	182,082	4,761	26	Kingstown	18,461	276	15·0
Callan	6,824	182	26·7	Limerick	44,209	1,127	25·5
Carlow	12,339	269	21·8	Listowel	11,365	267	23·5
Carriekmacross	8,253	142	17·2	Longford	12,089	285	23·6
Carrick-on-Suir.	11,788	309	26·2	Maryboro'	6,428	129	20·1
Cavan	9,908	219	22·1	Naas	6,021	181	30·1
Cork	91,965	2,481	27	Queenstown	14,411	283	19·6
Downpatrick	8,569	226	26·4	Tralee	21,998	606	27·5
Drogheda	13,246	185	13·9	Tuam	17,645	259	14·7
Enniskillen	12,211	242	19·8	Waterford	30,635	970	31·7
Gort	7,136	130	18·2	Westport	11,563	284	24·6

Wicklow is not to be found in a Registrar's District bearing its name.

There does not appear to be a close relation in all cases between the death-rates and water supplies of the above towns ; but in some of them—Waterford, Tralee, Naas, &c.—where the water is very bad, the death-rate is very high. In Kilkenny the water, though from a highly tainted source, does not contain much albuminoid ammonia, and therefore it does not so much affect the public health. Still 24·3 deaths per 1,000 is a high rate, especially when we consider that registration of death is defective in Ireland. In the towns with very bad water supply cholera was very virulent during its visitations in this country. The death-rate of Drogheda is apparently low, simply because the workhouse and hospitals are not within the registration area.

The pollution of a river, in its progress from its source to the sea, is well shown by the following results of analyses of the water of the Camac, which I made some years ago for certain legal purposes. The river rises in the Dublin mountains, and, flowing for about a dozen miles, commingles its muddy waters with those of the Liffey shortly after the latter enters Dublin.

COMPOSITION OF THE CAMAC RIVER AT DIFFERENT POINTS:—

		Grains per Gallon.		
	Mineral matters.	Volatile and Organic.	Total solids.	
1. One mile from the source, ...	2·12	1·84	=	3·96
2. Above Richmond Barracks, ...	13·	10·12	=	23·12
3. Below the Barracks, ...	51·20	26·00	=	76·20
4. Near junction with the Liffey, ...	96·35	47·56	=	143·91

During the outbreak of cholera in 1865 I found the pump water in Arklow, Mallow, and other towns ravaged by cholera in a very impure state, and I traced the spread of the disease, in many instances, to the use of foul water. At that time, however, the methods of water analysis were not so perfect as they are now.

CHAPTER X.

NORMAL AND ABNORMAL AIR.

The atmosphere by which our globe is invested extends to a height of forty-five miles—or, according to some observers, seventy miles—from the level of the ocean. A cubic foot of dry air, free from carbonic acid, weighs 537 grains (nearly $1\frac{1}{8}$ ounces), when the thermometer stands at thirty-two degrees Fahrenheit and the barometer at thirty inches. A column of air, extending from the ground to the extreme limits of the atmosphere, balances a column of mercury thirty inches in height, and one of water thirty-four feet in height; and it presses upon the surface of bodies with a force equivalent to fifteen pounds weight upon each square inch. The air decreases in specific gravity as it recedes from the earth. At the summit of Mont Blanc half the weight of the atmosphere is lost, the mercury in the barometer sinking to fifteen inches.

The atmosphere consists of several gases and vapours in a state of mechanical admixture, not of chemical union.

AVERAGE CENTESIMAL COMPOSITION OF THE ATMOSPHERE.

Essential.	{	Nitrogen ...	...	...	77·95
		Oxygen ...	...	...	20·61
		Watery Vapour ...	...	...	1·40
		Carbonic Acid ...	...	...	0·04
Possibly	{	Ozone ...	...	...	Traces.
Essential.		Ammonia ...	...	...
Non-Essential.	{	Nitric Acid ...	...	...	Traces.
		Carbonic Oxide ...	...	...
		Carburetted Hydrogen ...	...	...
		Sulphuretted Hydrogen ...	...	...
		Organic Matter ...	...	...

In addition to these substances, many others frequently occur, especially in the air of towns; for example, sulphuric, sulphurous, muriatic, and nitrous acids, chlorine, phosphuretted hydrogen, common salt, and various earthy and saline matters, and metallic vapours.

Oxygen gas is the most important constituent of the atmosphere; for most of the functions discharged by that fluid are, in reality, performed by oxygen. The respiration of animals and the ordinary processes of combustion are solely maintained through its agency; and many of the great changes continuously passing over the face of Nature are the result of the action of this potent element. Oxygen is about one-tenth heavier than atmospheric air. It is destitute of colour, odour, and flavour; 100 gallons of water dissolve between three and four gallons of it. No animal can exist in air which has been deprived of its oxygen, and fishes speedily expire when placed in water free from this vital element. Oxygen destroys the organic matters found in the air and in soils, by uniting with their carbon and hydrogen, and converting those elements into the carbonic acid and water. It also destroys vegetable colours—a property of which the linen and cotton manufacturers largely avail themselves, exposing their brown or yellow fabrics to the bleaching action of the air.

For a long time it was supposed that the relative proportions of oxygen and nitrogen in the atmosphere were the same under all circumstances; but recent and more accurate investigations into the composition of the air have shown that it is not constant. The variations, however, are within very small limits, and are produced almost solely by the processes of the combustion of fuel and the respiration of animals.

Ozone is oxygen gas in some peculiar condition, the precise nature of which is not thoroughly understood. It possesses a disagreeable odour, which some compare to that of diluted chlorine, others to that of phosphorus. We notice this odour during a thunderstorm, when phosphorus is exposed to the air, or when an electrifying machine is developing electricity; for, under those circumstances, some of the oxygen of the air is converted into ozone. It is a powerful bleacher, and readily decomposes several chemical compounds. It is probable that some of the effects of atmospheric air upon animals and vegetables, and their products, are produced by ozone. This remarkable body is formed by passing electric sparks through the air, or by slowly oxidising moist phosphorus.

Epidemics of influenza have been attributed to an excess of ozone in the air; and its absence from the atmosphere is supposed to favour the spread of if not to originate, certain zymotic diseases. During the outbreak of relapsing fever in London in 1870, Dr. Ross, Medical Officer of Health for St. Giles's District, noticed that the fever decreased inversely as the ozone in the atmosphere increased. When the mean amount of ozone was so low as 0.4 at

Greenwich, the cases of the disease amounted to 3·4 each day ; when the ozone rose to 1, the attacks decreased to 3 per diem. The days on which the ozone stood at 2, the attacks were 1 ; at 3, the cases of disease were 0·9 daily ; and when the ozone increased to 5, the attacks sank to 0·3 daily. These facts certainly do not appear to be mere coincidences. They show a close relation between the amount of atmospheric ozone and the intensity of a zymotic disease. They do not, of course, prove—that which has been so often alleged—that deficiency of ozone in the air is the direct cause of disease ; but they certainly go far to prove that ozone is capable of oxidizing the morbid agents which float in the air. It is to be regretted that Dr. Ross did not determine the amount of ozone in the atmosphere of his district. St. Giles is some distance from the Observatory at Greenwich. At the same time, it must be admitted that the amount of ozone in the air at Greenwich would be about the quantity which would exist in the atmosphere of all parts of the metropolis, provided it were not used up in oxidizing or ozonizing the organic matters and sulphuretted hydrogen gas which occur in sensible quantities in “London smoke.” It would be desirable that every medical officer of health should provide himself with the most modern and useful form of ozonimeter. The mode of using such an instrument is very simple ; and if it were constantly employed I have no doubt but that valuable medical results would follow.

A piece of paper or linen, soaked in a solution of starch and iodide of potassium, is a test for the presence of ozone, acquiring a blue or lavender tint on exposure to air containing a very minute trace of ozone. This curious substance can rarely be detected in the air of over-crowded rooms, or other places where the air is very impure. It is most abundant in the air above the ocean, and is seldom, if ever, absent from the atmosphere of the open country, because it is used up in destroying the organic matters which are so abundant in such situations. Ozone is abundant during snow-storms ; and it is supposed that the bleaching power possessed by newly-fallen snow is due to its presence.

Antozone is a term applied to another form of oxygen. It is supposed to be produced when ozone is formed, the oxygen being split up, so to speak, into these two curious bodies. Antozone has a disgusting odour, but a less pungent one than ozone. It soon passes into ordinary oxygen. It has the curious property of forming fogs or clouds with water ; perhaps it is the common cause of these phenomena. It must, however, be admitted that great uncertainty still prevails relative to the nature of antozone, and there may be no such substance in existence.

Nitrogen is colourless, tasteless, and odourless. It is a little lighter than atmospheric air. One hundred parts of water dissolve only two parts of this gas. Nitrogen cannot support combustion or respiration ; but by diluting the atmospheric oxygen, it renders that gas less stimulating to animals.

TABLE SHOWING THE PROPORTION OF OXYGEN IN AIR.

Authority.	Place.	Percentage of Oxygen.
Lewy	Atlantic Ocean, midway between Africa and America	20·96139
	British Channel	20·96321
	Bogota	20·02099
Dumas and Boussingault...	Paris	20·810
Stas	Brussels	20·865
Marignac	Geneva	20·784
Frankland	Summit of Mont Blanc ...	20·963
Brunner	Foulhorn	20·910
Miller	18,000 feet high (collected from a balloon)	
Regnault	Toulon Harbour	20·850
	Bengal Bay, over bad water ...	20·387
Leblanc	Chemical Theatre, Sorbonne, before lecture	20·760
	After lecture	19·860
	Close stable, Ecole Militaire...	20·39
Angus Smith	Street and suburb air, Manchester (mean of 32 analyses)	20·943
	Gallery of theatre, Manchester	20·630
	Large cavities in mine ..	20·770
	Under shafts ...	20·424
	In mines where candles go out	18 500
	North-east shore and open heath, Scotland	20·999
Bunsen	Marburg, Germany ...	20·960
Angus Smith	Average amount of air in open parts of London	20·950
	Average composition of air in worst parts of London streets	20·875
	Worst specimen ever examined in mines	18·270

Watery Vapour varies considerably in amount, being sometimes so low as 0.5 per cent., at other times so high as 4 per cent. The average amount is about 1.4 per cent. The warmer air is, the greater is its power of maintaining water in a vaporous state.

Carbonic Acid Gas is a compound of the elements carbon and oxygen; its specific gravity is 1.5224, water being 1. It has no colour, but possesses a slightly pungent odour, and its solution in water is feebly acid. It is fatal to animal life, even when largely mixed with atmospheric air; and a lighted taper is extinguished in air containing only a small percentage of this gas. It is extremely soluble in water, in which fluid it is invariably present, and often in large amounts. It is this gas which is driven off from limestone when that substance is ignited in kilns; and its presence imparts to champagne, bottled malt liquors, and mineral waters much of the agreeable flavour which those beverages possess.

The amount of carbonic acid gas in the air varies from three to six parts in 10,000 parts of air; the average is .04 per cent. It is sparingly present after rain, and accumulates during seasons of drought. It is more abundant in summer than in winter, at night than during the day, and over land than above water.

Carbonic acid gas furnishes the largest portion of the carbon used as food by plants; and the nitrogen of vegetables is to a great extent derived from ammonia. It is evident, then, that these gases are normal ingredients of the atmosphere; and it is not likely that, unless when present in excessive proportions, they exercise an injurious influence upon animal life.

Carbonic acid, though food for plants, is poisonous to animals, if taken into the lungs in large quantities. When limestone is strongly heated, nearly half of it is dissipated in the form of carbonic acid. Many poor, homeless creatures have lain down close to the lime-kiln fire, to enjoy its warmth, but, succumbing to the narcotic influence of the carbonic gas, have fallen into a sleep from which they never awoke on this earth. The carbonic acid which accumulates in brewers' vats, in the holds of corn-laden vessels, and in some other situations has often caused the death of persons who incautiously descended into it.

Dr. Smith states that an increase of atmospheric carbonic acid from 0.04 to 0.07 per cent., is in general recognizable by the senses. An increase of even 0.02 per cent. is not pleasant to us, when caused simply by want of ventilation; but if the increase be associated with an evolution of the gases of putrefaction—which is often the case—the deviation from the healthy atmospheric standard is the more dangerous to health. Indeed, the results of the experiments of Dr. Smith and those of Dr. Hammond, of the United States, show that the ill effects experienced by those who breathe air vitiated by respiration are chiefly due to the organic matter; for if the carbonic acid be removed by chemical means, the respiration of the air continues to produce an injurious

effect. In one of Hammond's experiments an animal died soon in re-breathed air from which the carbonic acid had been removed.

According to Dr. De Chaumont, Assistant Professor of Hygiene at Netley, the air of a room cannot be renewed more than six times per hour without producing draughts. The air may, however, be kept free from more than 0.06 per cent. of carbonic acid, and yet no draughts occasioned, if each person be supplied with 1,000 cubic feet of air and 48 square inches of ventilating openings. The openings should be exclusive of the chimney, if there be an open fireplace.

Dr. Smith has devised a simple form of apparatus, by which any person of ordinary intelligence and education might readily determine whether or not the amount of carbonic acid in the air of a place was above the normal, or any other proportion. Baryta water is a most sensitive re-agent for the detection and precipitation of carbonic acid. If half an ounce of baryta water, containing about 0.08 gramme of baryta, be placed in a clear glass bottle, having a capacity of 644 cubic centimetres (23 ounces), and the latter be well shaken, a turbidity (produced by a precipitation of barium carbonate) will be observed, if the proportion of carbonic acid in the air be 0.04 per cent.—that is to say, the 0.2515 cubic centimetres of carbonic acid contained in the bottle will unite with the barium of the baryta water, and form 0.00224 gramme of insoluble barium carbonate in half an ounce of water. The precipitate obtained renders the liquid turbid, but not quite opaque—it may be described as translucent. If a bottle of the capacity of 154 cubic centimetres (5.42 ounces) be employed instead of one of 640 centimetres, no turbidity is produced in the baryta water; on the other hand, if the bottle contain 44 ounces, or the air 0.08 of carbonic acid, the precipitate is twice as abundant. It is easy, then, by making an experiment in the pure open air, to observe the density of the turbidity caused by shaking half an ounce of baryta water in a closed bottle or jar of 23 ounces capacity; and if, on repeating the experiment in a room, the turbidity is increased, then it is to be concluded that the carbonic acid is in excess and the air impure. Any medical officer of health or hospital physician might, by the aid of a few clear glass bottles of different sizes and a supply of baryta water (lime water might be substituted for baryta water), easily ascertain the proportion of carbonic acid in the atmosphere of the places under his charge. A little practice would soon enable him to discriminate between the precipitate given by 0.04 and 0.08 per cent. of carbonic acid in air. As houses practically never have as pure air as the tops of mountains, we may rest satisfied when a bottle of 3.78 ounces avoirdupois capacity gives no precipitate when half an ounce of baryta water is shaken up in it. The air under such circumstances may contain 0.06, but cannot include 0.07 per cent. of carbonic acid. If lime water be used, then half an ounce of it (containing 0.0195 gramme of lime) is to be shaken up in a $10\frac{1}{2}$ ounce bottle, and it will remain clear if the carbonic acid be below 0.07 per cent.

100 *Minimetric Determination of Carbonic Acid.*

The following Table shows the size of the Bottle of Theain which gives no precipitate with $\frac{1}{2}$ ounce of Solution of Baryta, containing about 0.08 gramme when the Carbonic Acid is present in the proportions stated.

Air at 0° C. and 760 millms. bar.

Carbonic acid in the air, per cent.	Volume of air, in cub. centims.	Size of bottle, in cub. centims.	Size of bottle, in ounces avoirdupois.
.03	185	199	7.06
.04	139	154	5.42
.05	111	125	4.44
.06	93	107	3.78
.07	79	93	3.31
.08	70	84	2.96
.09	62	76	2.69
.10	56	70	2.46
.11	51	65	2.29
.12	46	60	2.14
.13	43	57	2.01
.14	40	54	1.90
.15	37	51	1.81
.20	28	42	1.48
.25	22	36	1.29
.30	19	33	1.16
.40	14	28	1.04
.50	11	25	.89
.60	9	23	.83
.70	8	22	.78
.80	7	21	.75
.90	6	20	.72
1.00	5.5	19.7	.70

In order to use this Table, first in its application to ordinary circumstances in life, we may assume that a bottle holding 5.42 ounces will not give any precipitate in the air around houses, if we live in a tolerably fair atmosphere. To try the experiment the bottle must be very wide-mouthed, so that we can put into it a rod covered with clean linen, and rub the sides dry and clean; we must then fill it with the air of the place, either by blowing in air with a bellows, or, better, drawing the air out with a pump, allowing that of the place to enter, or putting a glass or caoutchouc tube into the bottle, and inhaling the air out of the bottle, so that fresh may enter. No way is more exact than this, if care is taken not to breathe into the bottle. This care is not at all difficult to take, and no amount of apparatus can be more accurate than this method, if done intelligently. If the slightest amount of breath goes into the bottle, the process of rubbing clean and drying must be undertaken anew.

TABLE SHOWING PROPORTION OF CARBONIC ACID IN AIR
AT DIFFERENT PLACES.

Authority.	Place.	Percentage.
DaLuna 	Madrid—	
	Outside the walls—	
	maximum 	0·0900
	minimum 	0·0210
	mean 	0·0800
	Inside—	
De Saussure 	maximum 	0·0200
	minimum 	0·0450
	mean of 12 analyses ...	0·0520
	Geneva (mean of 13 analyses)	0·0468
C. A. Cameron 	Sleeping Cabin of Dublin	0·95
	Canal Boat 	
	Well-kept Cemetery (Glasnevin, Dublin) 	0·042
Angus Smith 	London, top of monument ...	0·0398
	Mean of 25 analyses of London street air 	0·0341
Smith and Bernays ...	Olympic Theatre, London ...	0·1014
	Pit of City of London Theatre	0·252
	Standard Theatre (pit) ...	0·320
Smith 	Manchester streets 	0·0403
	,, ,, close places	0·1604
Pettenkofer 	Air of Munich 	0·0500
	Bed-room with closed windows	0·2300
	Bedroom with open windows	0·0820
	Overcrowded school-room ...	0·7230
Roscoe , 	Unventilated barracks (London) 	0·1242
Angus Smith 	Open part of London (mean)	0·0301
	Metropolitan Railway ...	0·3380
H. Endemann 	Tombs Prison, New York ...	0·152
	Rossevelt-street School, New York 	0·320
	Fulton Market, New York ...	0·084

In stating the amount of oxygen, nitrogen, and carbonic acid in air, the latter is assumed to be dry, *i.e.*, free from watery vapour.

Dr. Angus Smith states that a very good specimen of air is that which contains by volume, oxygen, 20·96 ; nitrogen, 79 ; carbonic acid, 0·04—100.

Ammonia is a compound of the gases hydrogen and nitrogen. It is a gas much lighter than air, and is very soluble in water.

The pungency of smelling salts is owing to ammonia. In the air of Manchester Dr. Angus Smith found one grain of ammonia in $412\frac{1}{2}$ cubic feet, or 0.000453 per cent.

The amounts of sulphuretted hydrogen, carburetted hydrogen, organic matter, and the various other bodies which occur accidentally in the air, vary very much; but in general they constitute almost unweighable traces. In the air over the ocean the amounts of organic matter and sulphuretted hydrogen must be almost inconceivably minute. Common salt and carburetted hydrogen do not vitiate the air to an extent worth taking into account. Air containing only one-half per cent. of carbonic oxide is injurious to animal life. Sulphuretted hydrogen and phosphuretted hydrogen are very poisonous gases; and very frequently persons lose their lives in consequence of descending into sewers, the air of which contains a large proportion of sulphuretted hydrogen. The organic vapours and particles floating about in the air appear to be more injurious to animals than are all the other abnormal ingredients combined.

When atmospheric air is sensibly altered in composition, its effects upon animals are also modified, and often to a considerable and injurious extent. A trifling diminution in the amount of oxygen does not render air less wholesome, provided that the deficiency is made up by an excess of nitrogen. When, however, oxygen is deficient, it is generally found that carbonic acid is in excess. When the proportion of oxygen sinks below 20.5 it may fairly be assumed that the air is decidedly vitiated. On the other hand, when the percentage of oxygen rises to 21 there is little doubt but that the air is pure.

The solid matters in the atmosphere consist of a great variety of bodies. They comprise minute vegetables and animals, the germs of plants and animals, soot, fragments of linen, cotton, silk, and wool, hairs, particles of animal and vegetable substances. Minute traces of matters thrown off from animals exist in the air, and constitute the most dangerous part of the atmospheric organic matter. Pus has been detected in the air of hospitals, and particles of human skin may be found in the dust of most inhabited rooms. Chalvet collected the dust in a badly-cleaned and ill-ventilated hospital, and found it to contain from 33 to 46 per cent. of organic matter. The amount of combustible matter in atmospheric dust varies from 20 to 60 per cent.

Dr. Angus Smith found one grain weight of organic matter in from 176,000 to 209,000 cubic feet of pure air on high ground; in 56,000 cubic feet of the air of a bedroom; and in 8,000 cubic feet of the air contained in a crowded railway carriage. The headache and other pains which we suffer from in ill-ventilated places are nearly altogether the result of the organic matter, and not of the carbonic acid, of the vitiated air. Hammond found that a mouse died in forty-five minutes in air containing a large amount of organic matter, but no carbonic acid. Other experiments have afforded similar results.

Professor Tyndall has lately popularized the subject of atmospheric dust which previously was known only amongst scientific circles. Whilst making some experiments with beams of light, he found that the dust present in the air interfered with the results. This dust proved to be chiefly organic, and, therefore, combustible, and he destroyed it by passing the air through a platinum tube heated to redness. Professor Tyndall also noticed that the air passing into the mouth in the act of inspiration contained dust; whilst the air expired from the lungs was free from solid particles. As cotton wool absorbs and retains atmospheric dust when a current of air passes through it, Dr. Tyndall recommends persons who are obliged to be in contact with patients suffering from contagious diseases to wear respirators made of cotton wool. This advice is, of course, based on the germ theory of zymotic diseases; and it presumes that matters containing the seeds of virus of the disease are exhaled from the lungs and skin of the affected. Dr. Tyndall causes a ray of light to traverse the air. If it be visible to the ordinary observer, it is because germs of animals and plants (and, perhaps, of diseases), and other solid matters, are present. Where the air is free from solid matters, there the sunbeam—or, rather, what is popularly termed the sunbeam—is not visible. In ventilating buildings by forcing a current of warm air into them, would it not be advisable to subject the air to a temperature sufficiently high to destroy any organic matter which it might happen to contain? In heating and ventilating such buildings as the Houses of Parliament, where expense is not considered, it might be found practicable to employ highly heated air, subsequently cooled to the proper temperature for breathing it.

At a meeting of the London Chemical Society, held on the 3rd February, 1870, Mr. Chapman read a "Note on the Organic Matter contained in the Air." The author found that the air of crowded rooms contains suspended nitrogenous organic matter, as well as volatile organic bases. The first is removable by simple filtration through cotton wool; but the latter passes through filters, and when conducted through water can be detected therein. The air collected from the neighbourhood of a sewer contained decided quantities of these bases. Mr. Chapman suggests that it would be desirable to examine by this method the air of hospitals, fever wards, and similar places.

At a meeting of the Manchester Literary and Philosophical Society, held February 22, 1870, Dr. Arthur Ransome read a paper "On the Organic Matter of Human Breath in Health and Disease." The breath of eleven healthy and of seventeen persons affected by different diseases was examined. In both health and disease free ammonia was exhaled. Urea was sought for in the breath of three healthy persons and twelve diseased. It was found in two cases of kidney disease, in one of diphtheria, and, but in the minutest quantity only, in the case of a female suffering from catarrh.

A rough calculation was given of the total quantity of organic matter exhaled from the lungs in twenty-four hours. In the case of an adult it amounted to about forty-six grains. In kidney diseases a very large amount of organic matter was thrown off from the lungs. In a case of diphtheria confervoid filaments were observed; and in two other cases—one of measles, the other of whooping cough—numerous specimens of a small celled torula were detected.

The results of Dr. Ransome's experiments throw no light on the subject of the germ theory of disease. They show, however, the readiness with which the matters thrown out from the lungs support fermentation, and they afford a further illustration of the dangers arising from the ill-ventilation of hospitals.

Dundas Thompson and Caine¹ found sporules, confervoid fungi, vibriones, hairs, &c., in the wards of St. Thomas' Hospital, London, devoted to cholera patients. Pouchet has recorded (*Comptes Rendus*, Tome 48) the results of more than a thousand examinations of the solid matters floating in the atmosphere. He found therein, besides various kinds of mineral matter, species of vibriones, oxyuris, naviculæ, bacillaria, and diatoms; also epithelial scales, parts of insects, and various kinds of the *debris* of organized bodies. Pouchet's experiments were repeated and with like results by M. M. Joly and Muset (*Comptes Rendus* for 1860, page 647). Eiselt, Reviel, Devergie, Balbiani, Silvestri, Selmi, Robin Cohn, Beall, Samuelson, Wright, Douglas, Cunningham, Dareer, Sigerson, Sund, Angus Smith, DeChaumont, and Hogg have each of them published papers on the presence of organized structures in the atmosphere.

¹ Report of the Committee for scientific enquiries in relation to the Cholera Epidemic of 1854.

CHAPTER XI.

VENTILATION AND HEATING OF DWELLINGS.

An average sized man inspires about $16\frac{1}{2}$ cubic feet of air. Before inspiration this air usually contains from .04 to .05 per cent. of carbonic acid; after expiration from 4 to 5 per cent. of carbonic acid. It is not, therefore, merely necessary to supply a man with the actual quantity of air which he requires for inhalation, but with a quantity of pure air sufficient to reduce the percentage of carbonic acid in the gases expired from 4 to .04 or .05. The amount of air necessary for this purpose, as well as that sufficient to prevent a candle from vitiating the atmosphere, are shown in the following table extracted from Dr. Angus Smith's work, "Air and Rain," page 522:—

AMOUNT OF PURE AIR REQUIRED PER HOUR, IN CUBIC FEET.

Carbonic Acid per cent.	For a Man.	For a Candle.	For a Man and Candle together.
.4	100	50	150
.3	133	66	200
.25	160	80	240
.2	200	100	300
.1	400	200	600
.09	444	222	666
.08	500	250	750
.07	571	286	857
.06	665	333	1,000
.05	800	400	1,200
.04	1,000	500	1,500
.03	1,333	666	1,999
.02	2,000	1,000	3,000

Air re-breathed cannot apparently be made to take up more than 10 per cent. of carbonic acid, simply because animals cannot continue to breathe at all when the gas attains to that proportion. When air contains 3 per cent. of carbonic acid, lighted candles go out, and animals speedily die. The fatal effect of carbonic acid is due to the fact that it prevents expulsion of carbonic acid gas from the venous blood, which, consequently, rapidly accumulates and exercises a poisonous action. Regnault and Reiset have shown that in an atmosphere containing 40 per cent. of oxygen, instead of its usual proportion, animals can exist for hours, even when the proportion of carbonic acid is so high as 23 per cent.

The sick require more air than healthy persons. In diseases of an inflammatory character there is an abundant exhalation of organic matter, which, unless speedily oxidized, renders the atmosphere intolerable. A less supply than 3,500 cubic feet per hour is insufficient for a sick adult or even child. Gangrene, pyæmia, small-pox, erysipelas, and fevers taint the air to an extraordinary extent; and persons suffering from those diseases should be supplied with from 5,000 to 7,000 cubic feet per hour. In typhus and pyæmia almost complete exposure to the open air has been attended with the most favourable results. It is now generally acknowledged that persons suffering from consumption are much benefited by remaining in the open air during the whole day, unless the weather be unfavourable.

General Morin, in a report to the French Government in 1860, gives the statements shown in the diagram :—

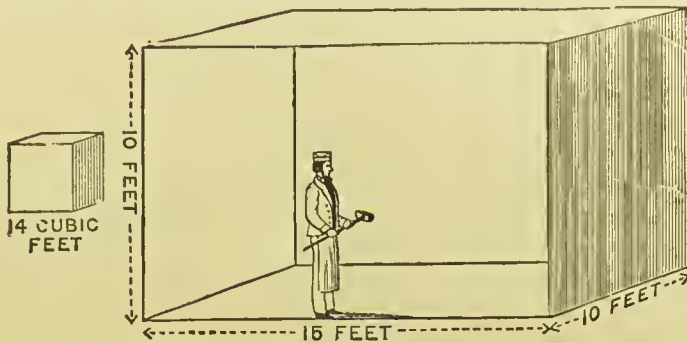
CUBIC FEET OF AIR REQUIRED PER HEAD, PER HOUR, IN TEMPERATE CLIMATES.

	Day.	Night.
In Barracks	1,059	2,118
Workshops, Prisons, and Theatres ...	2,118	—
Hospitals	2,825	—
Ibid., during dressing-hours	4,236	4,236
Ibid., during epidemics	5,650	5,650

In British barracks the regulation allowance of air is 1,000 cubic feet per hour.

The space allowed to each soldier in sleeping and other apartments is fixed by the military authorities at 600 cubic feet in permanent barracks; 400 in huts; 600 in wooden and 1,200 in permanent hospitals at home, and 1,500 in the tropics. According to the poor law regulations, each person is allowed 300 cubic feet to sleep in; 500 if sick. A room 10 feet high, 15 feet long, and 10 feet wide contains 1,500 cubic feet of air, and may, according to the Dublin Sanitary regulations, accommodate five persons. The atmosphere of the largest room in which persons are living becomes bad, unless there are apertures of sufficient magnitude to admit fresh air and to allow the foul air to escape. In a sleeping apartment there should be an opening of 24 square inches to admit the fresh air required for one individual—adult or child. The inlet aperture should be lower than the outlet one, and one of equal size to allow of the egress of vitiated air.

The diagram shows the comparative size of a man and that of

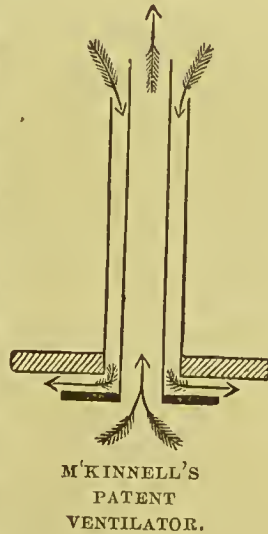


a room of the dimensions described. The cube shows the quantity of air which every hour passes into the lungs of one person, averaging both sexes and all ages.

The outlets for the vitiated air should, as a rule, be removed as far as possible from the inlets for the pure air ; otherwise the circulation of the air throughout the apartment will not be perfect. In M'Kinnell's ventilator, however, the inlet and outlet are close together. This ventilator is intended to introduce the pure air through the ceiling. It consists of two tubes, one placed within the other. The inner is a little longer than the outer one, and through it the vitiated air escapes. The outer tube is that through which the pure air descends into the room ; and the lower part of it being provided with a flange, the air at first spreads along the ceiling, and afterwards descends by the walls to the lowest part of the room.

Arnott's ventilator is simply an opening, provided with a valve, leading into the chimney. It is most useful for the purpose, but occasionally smoke from the chimney forces a passage through it into the room.

The air thrown off from the body and the gaseous products of combustion are light, and ascend ; therefore the vitiated air should pass out at the highest point of the apartment. The purer and heavier air should be admitted about eight feet above the floor. If the apartment is ventilated by heated air, then the openings for its admission may be at or near the floor ; but cold air flowing into a room at the lowest point occasions much discomfort, by cooling the feet, and in other ways. The air may be warmed by passing it through boxes heated by coils of pipes, through which a current of steam or of hot water flows ; but under no circumstances should air from a furnace be



admitted into rooms. An economical method of introducing pure, warm air into a room is to construct the open fireplace or stove flue in such a way that the air heated by the outer surface may pass into the room. This system of simultaneously heating and ventilating apartments has been found very successful in many hospital wards and barrack-rooms.

The Sherringham valve is an excellent contrivance for admitting fresh air without occasioning a draught, unless when a very strong wind blows upon it. It can be used either as outlet or inlet, by fixing the hinged valve in the necessary position, and the valve can, if necessary, be closed by a balanced weight. This valve is generally placed in the upper part of the wall, and it is usually 9 inches by 3, with an area of 27 square inches.



SHERRINGHAM VENTILATOR.

Dr. DeChaumont in his excellent pamphlet on ventilation states :

1. We cannot safely accept a lower standard than .06 per cent. of carbonic acid.
2. We cannot safely legislate for anything short of uniform diffusion in an air space.
3. Uniform diffusion being supposed, we cannot preserve our minimum standard of purity with a less delivery of fresh air than 3,000 cubic feet per head per hour.
4. We cannot safely change the air on an average oftener than six times in an hour without producing draughts.
5. With ordinary means of ventilation, we can seldom hope to succeed in changing the air even six times in an hour.
6. We must provide an air space which will admit of the delivery of 3,000 cubic feet per head, per hour, and at the same time preclude the necessity of changing the whole air so often as six times per hour.
7. To fulfil all the above conditions, a minimum of 1,000 cubic feet per head is absolutely necessary.
8. To provide the supply of 3,000 cubic feet per head per hour, so that the velocity of the current at the point of entry should not exceed 5 feet per second, 48 square inches of total inlet and outlet area ought to be provided, and this independent of the chimney, if there be an open fireplace.

Where gas is burned, it is desirable to have an opening in the ceiling exactly over the gas-lights, and a tin tube leading from it direct to the open air. The cost of the tube (which is placed between the ceiling of the room to be ventilated and the floor of the one above it) is trifling. When the tube is passed into the air, it should not be carried up too high, otherwise down-draughts might be produced. Perforated bricks are now very generally placed in the walls of houses. Iron frames covered with perforated zinc are good substitutes for the porous bricks ; when provided with valves—to close them if necessary—they are very good ventilators. Louch's ventilator consists of a wooden box, containing three or four partitions of perforated zinc. The box is inserted obliquely in the wall near the ceiling, and the air passing through it is

divided into numerous currents and directed towards the ceiling. This ventilator works very well, but it does not secure complete immunity from draughts.

The archimedean screw ventilator is a screw placed in a cylinder and worked with a fan turned by wind. It is placed on the tops of chimneys in the summer, and also on the tops of ventilating shafts. I do not think it pumps much air out of rooms; but it serves to prevent downward currents. The fan turns easily with the wind.

Many plans have been proposed for ventilating and heating churches, theatres, and other large buildings.¹ In summer, cold air, and in winter, warm air may be, by propulsion, introduced into large enclosed spaces. One advantage of this plan is that the air may be obtained from a great height above the level of the ground, where it is most likely to be free from organic impurities. In towns, however, air taken from a lofty situation is generally contaminated with smoke.

In ordinary rooms, the doors, windows, and fireplaces ought, when possible, to be used as ventilators. A sitting-room with an open window, an open fireplace, and an open door seldom has an impure atmosphere. In some institutions there are three sashes in each window—an excellent contrivance for either admitting air or allowing it to escape at different heights from the floor.

By far the best place to introduce fresh air into a room is close to the fireplace. Gauger's plan for this purpose is excellent, but costly, unless at the building of a house. It consists in having a chamber behind the fireplace and its flue, whereby the latter are separated from the outer wall of the building. The chamber communicates on the one side with the open atmosphere, on the other with the room. The air entering the chamber is heated by contact with the back of the fireplace and flue, and is then delivered fresh and warm into the apartment. Some modification of this plan ought to be adopted in the building of houses, even of the humblest character; and I commend it to the attention of the authorities of towns such as Belfast, in whom there are powers vested, to regulate the construction of dwellings proposed to be erected.

In houses already built the air might be admitted into rooms in the following manner. Make air channels in the wall, between the floor of the room to be ventilated and the ceiling of the one beneath it, and admit the air into the room from openings near the hearthstone. This arrangement need not in any way disfigure the apartment. The size of the openings taken together should be at least 36 square inches.

The advantages of ventilating a room by openings near the fireplace are very great. Draughts from the doors and windows are avoided. The fresh air is introduced exactly at the place where (at least during the time that fuel is consumed for the purpose of

¹ See Chapter on Construction of Hospitals.

heating rooms) it is most wanted. When the fresh air enters a room by door or window, or ordinary ventilating aperture, it passes upwards to the openings near the ceiling usually provided for the egress of fresh air. The occupants of the room, who in winter usually are to be found near the fireplace, breathe impure air, because the fresh air that ought to circulate about them is carried high over their heads into the openings near or in the ceiling. When the fresh air enters the room at the fireplace it becomes heated and expands in every direction, and finally passes up into the chimney without causing the inconvenience of a draught.

The registers so generally used in flues of domestic fireplaces are, on the whole, more hurtful than useful. They too often prevent the chimneys from acting as efficient ventilators. In summer the registers are almost invariably closed, and the chimneys thereby prevented from acting as ventilators.

The effect produced on air by the combustion of candles, oil, gas, and fuel is nearly the same as that caused by respiration. One pound weight of oil consumes about 140 cubic feet of air. Every cubic foot of coal gas uses up the oxygen of from 14 to 15 cubic feet of air. An ordinary gas-burner consumes nearly 45 cubic feet of air per hour, and, therefore, vitiates the atmosphere of a room to an extent nearly equal to that produced by the respiration of three men. In calculating the quantity of air to be supplied to rooms in which people are sleeping or working, the number of gas-lights, candles, or lamps, and the quantity of fuel burning in them, must be taken into account.

The following table shows the number of cubic feet of carbonic acid produced by the combustion of various illuminating agents in such quantities during 10 hours as to evolve a light equal to that given by 20 sperm candles, each weighing 120 grains:—

Tallow	..	... 10.1	Manchester Gas	... 4.0
Spermaceti	...	... 8.3	Cannel Coal Gas	... 3.0
Sperm Oil	...	... 6.4	Boghead Coal Gas	... 2.6
London Gas	...	... 5.0		

A rich coal gas, therefore, gives as much light, and but one-fourth the carbonic acid, as is evolved from tallow candles; and the latter, in producing as much light as cannel coal gas yields, evolve twice as much heat.

It is difficult to heat economically rooms with numerous or large windows, because the thin sheets of glass (cooled externally by frosts or winds) withdraw the heat from the air of the apartment. Every one knows that the place near the window is the coldest part of the room in the winter. On the Continent, double window panes, with an air space between them, are very common. In these countries, hospitals and other public institutions should be furnished with sashes provided with double panes. The air space, say $\frac{1}{2}$ -inch between each pair of panes, would, by its bad heat conducting power, serve to prevent the transmission of heat through the window. Banks, public offices, and other places pro-

vided with skylights are often very cold, notwithstanding a liberal combustion of fuel. Such places should have their skylights provided with double panes.

Silliman shows,¹ from actual experiment, that the same quantity of gas evolves, by its combustion in large burners, more light than when it is consumed in smaller ones. When a moderate and equally diffused light is required over a large space, it may be expedient to use a large number of small burners; but when a *maximum* intensity of light is desired, burners of ample flow are the best and most economical that can be employed. This subject is of interest in a hygienic point of view, for the less gas burned in our apartments the purer will be the atmosphere. It would be most desirable if the products of the combustion of the gas consumed in lighting theatres and other public places were prevented from mixing with the air inspired by the audience. Gas might be burned in enclosed spaces, provided with glass sides to allow the light to pass through, and illuminate the apartment, and with a flue through which the products of combustion might be transmitted to the open air.

Wind is one of the best natural ventilators, not only in the case of open places, but even in our dwellings. Its velocity extends from a few feet to 110 miles per hour. Its pressure upon a square foot of surface ranges from less than an ounce to fifty pounds. A light breeze moves at about eight or ten miles an hour, a moderate wind eighteen miles, a gale thirty-five to fifty miles, a storm sixty to seventy-five miles, and a hurricane eighty to 110 miles. In these islands the average annual motion of the wind is about seven miles per hour. Every variation in the temperature of the air produces a wind: for example, in winter the higher temperature of the interior of a dwelling, as compared with the air outside of it, produces a wind, the direction of which is towards the house. The mode in which wind ventilates is easily explained: it rapidly carries off the organic matter and other impurities, and mixes them with the great bulk of the atmosphere, where they are either oxidised or rendered harmless by excessive dilution. When the wind is strong, it forces its way into houses even when the arrangements for ventilation are most imperfect. It passes even through brick walls, especially when they are old and dry, and, consequently, very porous. It forces its way through the smallest clink or flaw; and no door or window is so perfectly fitted in its case as effectually to exclude the wind. What is called thorough or through ventilation is, to allow the wind to blow freely right through a house. Moving at the rate of a mile an hour—a motion almost imperceptible—and allowed to pass freely through a room, it will renew the air in it 270 times per hour. The great advantage of keeping open every window in the house for a few hours daily is the admission of so large a quantity of air that the organic

¹ *American Journal of Science and Art*, January, 1870.

matter floating in the atmosphere of the apartments cannot escape oxidation. The excess of carbonic acid gas in a room can be got rid of by keeping the windows open for a few minutes; but the organic matter thrown off from animals requires prolonged exposure to pure air before its noxious properties are perfectly destroyed. The humbler classes appreciate so little the value of abundance of pure air that the rarely take any measures to ventilate their sleeping apartments. It is, perhaps, fortunate for them that the imperfect carpentry of their dwellings usually prevents their attempts to utterly exclude the air.

If two vessels, each filled with a different gas, be allowed to communicate with each other, both will, after some time, be found to contain equal proportions of the two gases. Hydrogen gas is twenty-two times lighter than carbonic acid gas; yet, if a vessel filled with the heavier of these gases be placed *under* one containing the lighter, the hydrogen will instantly begin to descend, and the carbonic acid to ascend, and after a certain time equal proportions of the two gases will be found in both vessels. As a room is never absolutely air-tight, the gases contained in it diffuse themselves into the atmosphere, and gradually become replaced by fresh air derived from the outside. It is owing to this property of the diffusibility of the gases that the air in the room is renewed, even when there is no wind; but it is not sufficient to maintain the atmosphere of a room pure, unless the openings are sufficiently large to permit the free interchange of the gases.

The amount of disease produced by breathing air containing excessive amounts of carbonic acid, sulphuretted hydrogen, and organic matters is really fearful to contemplate, more especially when one reflects that it is nearly altogether the result of ignorance or carelessness. Headaches and nausea are the common results of breathing air which has repeatedly been respired; and rigors are sometimes produced under the same circumstances. "The breathing of slightly vitiated air for even a few hours produces," says Dr. Parkes, "increased temperature, quickened pulse, furred tongue, loss of appetite, and thirst, for even forty-eight hours afterwards. The continued respiration of the same quantity of air renders it at length a deadly poison." Every one has heard of the dreadful sufferings endured by a party of our countrymen, who, on the night of the 18th of June, 1756, were immured in the notorious "Black Hole" of Calcutta, by order of Surajah Dowlah, Nabob of Bengal. They and their dependents, to the number of 146, were forced into a room only eighteen feet square. The atmosphere of the confined place speedily became poisoned with carbonic acid and organic matter. An agonising scene lasted all night; and in the morning the bodies of 123 poor creatures lay breathless upon the floor. Of the few survivors, many died shortly afterwards, and most of the others lingered on miserably for a few years. One of the most recent cases of what may be termed wholesale poisoning by means of vitiated air occurred on board the steamer *London-*

derry, in the year 1848. This vessel was on a voyage from Sligo to Liverpool, when, a storm coming on, the captain confined 200 passengers below the hatches, which he battened down and covered with a tarpaulin. The space in which the poor people were crowded afforded to each person but seven cubic feet of air—300 feet being, as already explained, the smallest quantity allowed to each person in the dormitories of the workhouse. Imagination fails to realise the horrors of the living tomb into which these persons were forced, and in which nearly 100 of their number laid down their lives—poor victims sacrificed on the altar of ignorance ! During the voyage of the emigrant ship *Liebnitz* from Hamburg to New York, Nov., 1867, 108 out of 544 passengers died in consequence of overcrowding, want of ventilation, and the filthy condition of the vessel.

With respect to the ventilation of stables, horses require 2,000 cubic and 100 square feet, and cows 1,500 cubic feet and 100 square feet. In cow-houses the amount of space, square and cubical, allowed to each animal is almost always totally inadequate.

Ventilation is a process which should take place unceasingly. Every day the windows and doors of each apartment should be left open for several hours. No room—nor even lumber store—should be kept constantly closed. The condition of the sleeping-places of servants is much neglected ; indeed, the air in them often becomes tainted, and diffuses its noisome properties throughout the atmosphere of the whole house. Inconsiderate mistresses appear to act on the principle that any place is good enough for a servant to sleep in. If a commission were appointed to inquire into the sleeping accommodation of domestic servants, curious revelations would be the result. The ventilation of bedrooms is better attended to now than formerly. Until lately it was the fashion to exclude air from them by every possible contrivance. The windows were carefully closed, the door shut, the chimney in summer stopped up, and no openings provided in their place to allow the passage of air. In winter, sand bags were placed at the juncture of the window sashes, and similar contrivances were used to prevent air from passing under the door, or even through the keyhole ! The furniture, too, was massive and encumbered with upholstery. The bed was surrounded with heavy curtains, and covered with a canopy. This style of sleeping apartment is still met with, but far less frequently than formerly. There is now some provision for ventilation ; the furniture is lighter and less absorbent, and the hearse-like “four-poster” is rapidly being supplanted by the light and uncurtained iron bedsteads.

The dwellings of the poorer classes in towns are in general placed under extremely insanitary conditions. The rooms are mostly small, and are overcrowded—in thousands of instances affording only from 100 to 200 cubic feet of space for each inmate. The appliances for the removal of refuse are incomplete, and the atmosphere of the place is, therefore, permanently tainted.

The houses are too close together; there are either no yards or very small ones; the supply of water is defective—often from the want of vessels to store it in; and the rooms and passages, the furniture, clothes, and persons of the inmates are in a chronic state of filth. These sad tenements of humanity are the “fever nests” wherein are hatched the germs of many of the direst diseases that afflict mankind. In improving their condition, we are not performing altogether unselfish labour; for the virus of small-pox or of typhus spreads from the homes of the very poor, and carries death into the mansions of the rich. The dwellings for the industrial classes erected in London through the princely munificence of the great philanthropist, Mr. Peabody, and the model lodging-houses built in various towns, now afford healthful, decent, and cheap dwellings for a large number of the working classes.

Hospitals, barracks, and similar institutions are now generally constructed on proper sanitary principles. Formerly the converse was the rule, and the mortality within their walls was consequently extremely high. During the first quarter of a century after the establishment of the Dublin Lying-in Hospital, one out of every seven children born in it died. The cause of this prodigious mortality was found to be the want of proper ventilation, and on remedying the defect the number of deaths immediately fell to one in 104. In the dormitories of workhouses and schools there still exist overcrowding and a want of proper ventilation; but, as a general rule, the sanitary conditions of public institutions, where large numbers of people are lodged, are being steadily improved.

In theatres, concert-rooms, and other buildings where large numbers of people congregate, the superficial space devoted to each person is rarely sufficient. It is quite possible to overcrowd a building which, having the sky for its roof, affords to all within its walls unlimited cubic space for breathing in. If people are placed too close together, the most perfect appliances for ventilation will not prevent each of them from inspiring the foul air expired from his own and his neighbours' lungs. The owners or managers of all places of public resort should be compelled to provide adequate square as well as cubic space for each person. In the London lodging-houses the space of thirty superficial feet is allowed to each person, and in the section houses of the Metropolitan Police fifty superficial feet. In hospitals each patient should have at least 100 square feet.

Notwithstanding the high price of fuel, the wasteful combustion of that substance in open fire-places is preferable to its more economical use in close stoves. It was experimentally found that 1,000 cubic feet of air were transmitted every minute out of a large room through its open chimney. Open fire-places are, therefore, ventilators of the most effective kind. The back part of fire-places should be composed of fireclay, and the metallic parts should be kept as bright as possible, in order to radiate the heat into the apartment.

The results of the experiments of General Morin, H. St. Claire Deville, Froost, Canet, and other chemists and physicists, appear to show very conclusively that iron stoves, by permitting the passage of the products of combustion through their walls, exercise an injurious influence upon the public health. The late Professor Graham proved that carbonic oxide gas was capable of passing through solid iron, provided the metal was heated to redness. As the front and sides of stoves are liable to become red hot, a large quantity of carbonic oxide generally escapes from the stove into the atmosphere of the apartment. The denser the fuel is, the greater the quantity of carbonic oxide formed during its combustion. Anthracite (in Ireland popularly termed Kilkenny coal), or flameless coal, and coke, produce more carbonic oxide than the bituminous, or flaming coal, and the latter develops more carbonic oxide than turf (peat) and wood. We may regard wood and peat as the fuels which, during their combustion, exercise the least injurious effect upon health. Dr. Derby, of Boston, Lecturer on Hygiene in Harvard University, United States, in a little work on "The Influence of Anthracite Fires upon Health," published late in 1868, states that the anthracite stoves used in America exercise a very prejudicial influence upon health. He recommends the following rules to be observed in burning hard fuel in cast iron stoves:—

1st. To use fire-brick or soapstone (silicate of magnesia) in contact with the fire, and never to allow the fire-pot to get red hot.

2nd. To have perfect castings, and as few joints as possible; and these joints should be horizontal, and not vertical.

3rd. Never to cut off the supply of air to the fire, and never to check the free escape of the products of combustion to the chimney by dampers, or by cooling the fire by the admission of air between the furnace and the chimney.

4th. To so burn the coal that, under all possible circumstances, a pressure of air from without inwards may be exerted upon the fire-pot radiators and smoke-pipes.

Dr. Sacc (*Les Mondes* for January 20th, 1870) asserts that cast iron stoves, even if they are allowed to become red hot, are not injurious to health, provided that there is proper ventilation and a good draught into the chimney—or, rather, into the pipe leading from the stove to the chimney. According to Sacc's experiments, cast iron stoves are only injurious to health when rendered so by imperfect draught—a defect, however, which applies equally to all kinds of stoves and fire-places. I know, however, from personal observation, that the air close to red hot stoves produces headache and other unpleasant effects.

CHAPTER XII.

POLLUTION OF THE ATMOSPHERE BY MANUFACTORIES

In the manufacture of various articles, such as oil of vitriol, artificial manures, ammonia salts, salt cake, illuminating gas, &c., large quantities of gases and vapours, more or less injurious to health, are thrown into the atmosphere. In the production of certain commodities, such as bread, flour (in steam mills), &c., large quantities of fuel are consumed in short periods of time, and often in badly constructed furnaces, producing large volumes of black smoke. These gases, vapours, and black smoke constitute very often nuisances of a serious nature, which in some towns have constantly to be investigated by the officers of health. In Ireland the number of distinct manufactures carried on is far less than in England and Scotland; and the following list of those which sometimes create nuisances comprises all that are likely to demand attention from the sanitary officers:—

<i>Manufacture, &c.</i>			<i>Nature of Nuisance.</i>
Artificial Manures	...	...	Smoke, bad odour, hydrofluoric acid, sometimes sulphurous acid and nitrous acid.
Asphalte	...	...	Unpleasant odour, smoke.
Ammonia Salts	...	...	Sulphuretted hydrogen gas, prussic acid.
Bone Black	...	...	Bad odour, injurious emanations.
Bone Boiling	...	...	Ditto.
Bacon ..	...	...	Bad odour.
Bleaching Powder	...	...	Chlorine.
Bread and Biscuits (bakeries)	...	...	Smoke.
Brewing Porter, Ale, &c.	...	...	Smoke.
Bricks	...	...	Smoke, carbon gases.
Cotton Spinning	...	...	Smoke and Dust.
Candles	...	...	Smoke, injurious emanations.
Coke and Charcoal	...	...	Smoke, carbonic acid and oxide
Currying	...	...	Injurious emanations, bad odour.
Distilling Spirits	...	...	Smoke.
Dyeing	...	...	Pollution of water.
Feathers (cleaning, &c.)	...	...	Dust.
Felt	...	...	Bad odour.
Fish Curing	...	...	Bad odour, injurious emanations.
Flour and Meal	...	...	Dust.
Ditto (steam mills)	...	...	Smoke and dust.
Flax Steeping	...	...	Bad odour, injurious emanations.
Gas (illuminating)	...	...	Gaseous compounds of carbon and hydrogen, and of carbon and oxygen, carbon disulphide, prussic acid, sulphuretted hydrogen, smoke.

<i>Manufacture, &c.</i>	<i>Nature of Nuisance.</i>
Glass Bottles, &c. ...	Sulphuric acid, carbonic acid and oxide, muriatic acid, smoke.
Glue and Size ...	Bad odour, injurious emanations.
Gut Cleaning (gut string, &c.) ...	Ditto.
Grease ...	Ditto.
Iron Smelting and Casting ...	Carbonic acid and oxide, smoke.
Kelp ...	Bad odour, smoke.
Lead Smelting ...	Vapour of lead, antimony and arsenic, sulphurous acid, smoke.
Lead Pipe Making ...	Lead and other metallic vapours, smoke.
Lime ...	Carbonic acid and oxide, smoke, dust.
Leather (tanning) ...	Bad odour.
Muriatic Acid ...	Muriatic acid.
Metals (smelting of) ...	Metallic vapours, carbonic oxide, and acid.
Nitric Acid ...	Nitrous acid.
Oils, especially animal ...	Bad odour, injurious emanations.
Pipes (tobacco) ...	Smoke, carbonic oxide and acid.
Paper ...	Pollution of water with bleaching powder, soda ash, &c.
Potteries ...	Smoke, dust, carbonic oxide, and acid.
Rag Sorting and Cleaning ...	Bad odour, dust.
Salt Cake ...	Sulphurous and muriatic acids, smoke.
Sugar ...	Smoke, sometimes bad odour.
Sulphuric Acid ...	Nitrous and sulphurous acids, smoke.
Starch ...	Pollution of water with soda, albuminous matters, &c.
Soap ...	Bad odour, injurious exhalations.
Tallow Melting ...	Bad odour.
Tar and Naphtha ...	Smoke, sometimes bad odour.
Washing Clothes, &c. ...	Pollution of water with soda, bleaching powder, and dirt.
Woollen Cloth, Worsted, &c. ...	Unpleasant odours, smoke.

The gases and vapours which escape from chemical works are chiefly sulphurous acid (fumes of burning sulphur), nitrous acid, muriatic acid, and chlorine. When they constitute a sensible proportion of the air, they act injuriously on the respiratory organs, producing, in extreme cases, bronchitis and inflammation of the lungs. The nature of these gases will be explained in the chapter on "Disinfectants."

Carbonate of soda is manufactured upon a large scale in England. The first step in the process is to convert common salt into sulphate of soda, or salt cake. This is accomplished by treating the salt with sulphuric acid: the products of the re-action are sulphate of soda and muriatic acid gas. The muriatic acid, being incidentally produced in larger quantity than is required, was formerly permitted to escape into the air, [and often in such quantities as to injuriously affect both animal and vegetable life. The

Alkali Nuisance Prevention Act, passed in 1864, compels the salt-cake manufacturers to prevent the escape of at least ninety-five per cent. of the muriatic acid produced in their works.

Ammoniacal compounds are manufactured from a liquid obtained from coal-gas works. It contains tarry matters, creosote, and compounds of ammonia with carbonic acid and sulphuretted hydrogen. On pouring sulphuric or muriatic acid into this liquid, the carbonic acid and sulphuretted hydrogen gases are expelled, the stronger acid taking their place. As this operation is conducted upon a very large scale, immense volumes of sulphuretted hydrogen are often daily discharged into the air from "ammonia works." Sulphuretted hydrogen gas, being combustible, is completely decomposed at a high temperature; and this, and many other of the noxious volatile bodies produced during various manufacturing processes, might be rendered harmless, or less injurious, if passed through burning fuel.

Chlorine and sulphurous acid are powerful disinfectants, and, unless evolved in such quantities as to act corrosively upon the tissue of the lungs, are useful additions to an atmosphere containing sulphuretted hydrogen and organic matter. In many cities the coal gas and chemical works are situated in the same quarter; their exhalations, therefore, neutralize each other, and produce comparatively innocuous bodies.

In extracting copper and lead from their ores, sulphurous acid, sulphuric acid, arsenic, and even lead are volatilised, and the exhalations from copper smelting works in England have been known to injure large tracts of vegetation. Herbage affected with sulphurous acid often, it is stated, produces disease in the animals fed upon it.

Tar and creosote works evolve vapours which, though rather unpleasant to smell, are not dangerous to health, unless breathed in much larger quantities than generally occur in the atmosphere.

In works where illuminating gas is manufactured, it is difficult—owing to the magnitude of the operations—to prevent noxious gases and vapours from escaping into the atmosphere. Coal is the raw material employed, and it is heated to redness in close vessels, whereby it is resolved into a variety of substances—solid, liquid, and gaseous. The solid product is coke, which remains in the vessels, or *retorts*, as they are called; the liquids consist of a great variety of substances, resembling naphtha; the gases are hydrogen, light and heavy carburetted hydrogen, carbonic acid, carbonic oxide, nitrogen, sulphurous acid, sulphuretted hydrogen, ammonia, and prussic acid; the vapours are compounds of hydrogen and carbon resembling naphtha, and a substance composed of carbon (charcoal) and sulphur, termed di or bi-sulphide of carbon, which possesses an unpleasant odour. Owing to leaks in the various parts of the apparatus, small quantities of all these volatile bodies constantly escape into the air, even from the best managed works; it would, therefore, be desirable, when building gas works, to select

a site in a thinly-populated place, and as far from the town as possible.

When the gases and vapours issue from the retorts they are subjected to the action of water and lime. The tarry liquid, nearly all the ammonia, and some of the sulphurous and carbonic acids, and sulphuretted hydrogen, are retained by the water. The lime takes up the rest of the sulphurous acid, sulphuretted hydrogen, and carbonic acid, and the traces of prussic acid which escape solution. The gases that remain pass into the gas-holders, and from thence to the points at which they are to be consumed for illuminating and heating purposes. Unless great care is taken in purifying the gas before it is delivered to the consumers, it is certain to contain sulphuretted hydrogen. Impure gas is most injurious to the health of inmates of rooms where it is burnt. Ammonia is never absent; but it cannot be regarded as an injurious impurity. Disulphide of carbon is a most objectionable impurity, and is invariably present. When burned it produces an acid, which acts corrosively on the leather binding of books and on many other articles. When coal gas contains an injurious amount of impurities it becomes a nuisance, and the manufacturer may be compelled to abate it.

The lime used in purifying coal gas is a nuisance when it is allowed to remain in large quantities exposed to the atmosphere, into which it abundantly exhales sulphuretted hydrogen gas. Oxide of iron is now very generally substituted for lime as a coal gas purifier. The oxide, mixed with sawdust, is placed in layers ten or twelve inches deep on perforated trays or shelves, through which the gas passes. So soon as the absorption of sulphuretted hydrogen gas is complete, the sulphide (into which the oxide has been converted) is exposed to a current of air, which reproduces the oxide, and sets free the sulphur. This purifier can, therefore, be repeatedly used, until it becomes mixed with too much sulphur; even then it is valuable to the sulphuric acid manufacturer. The drainage from gas works should never be allowed to mix with sewage from chemical works, the acid contained in the one setting free the sulphuretted hydrogen and prussic acid dissolved in the other. The gases evolved from such a mixture have destroyed the lives of workmen.

Coke works and lime kilns discharge enormous quantities of carbonic acid and carbonic oxide into the air. They should not be tolerated within the limits of towns. Carbonic acid, carbonic oxide, and traces of sulphuretted hydrogen gas are given off during the manufacture of bricks and cements.

Artificial manure works in general throw out sulphurous acid gas. Sometimes the odours of decomposing animal matter and of hydrofluoric acid are very perceptible at and near these works; but in general they do not affect the atmosphere to a greater extent than alkali works.

Private slaughter-houses are amongst the greatest nuisances

from which the inhabitants of towns suffer. The atmosphere of those places is highly tainted with putrescent matters; and the exhalations from them cannot but seriously affect the public health.

Bone-boiling, tallow-melting, and glue-making are processes during which are evolved vapours of no very pleasant odour. If the nuisance be very sensible, it admits of a remedy either by an action at common law or by the interference of the public health authority.

The air of towns is tainted with the products of the combustion of fuel. Carbon constitutes the great bulk of ordinary fuel: at a high temperature it unites with atmospheric oxygen, and produces carbonic acid. The quantity of heat evolved during combustion depends upon the amount of oxygen consumed by the fuel. Carbon unites with oxygen in two proportions, forming carbonic acid and carbonic oxide: the centesimal composition of these compounds is shown in the table:—

		Oxygen, Per cent. by weight.		Carbon, Per cent. by weight.
Carbonic oxide ...	...	57.14	...	42.86 = 100
Carbonic acid ...	...	72.72	.	27.28 = 100

Carbonic acid is carbon in a perfectly oxidised or mineral state but carbonic oxide is charcoal imperfectly burned, and it is a highly combustible body. When carbon is converted into carbonic oxide instead of carbonic acid, sixty-seven per cent. of the fuel is wasted; and it is owing to the defective construction of furnaces that a large quantity of the fuel used in manufactories is lost, because its carbon is converted into carbonic oxide. The pale flame which is sometimes seen emerging from high chimneys is produced by highly heated carbonic oxide, combining with the atmospheric oxygen.

Limited oxidation is a cause of the evolution of carbonic oxide from furnaces, stoves, and fire-grates. Sometimes the carbon of the fuel is at once converted into carbonic oxide; at other times carbonic acid, formed where the air is abundantly supplied to the fuel, is afterwards converted into carbonic oxide by contact with red hot carbon. The greater part of the fuel in furnaces is in a state of incandescence, but not of combustion—that is, it is so highly heated by the burning part of the fuel that it becomes luminous. Carbonic acid gas, passed over incandescent charcoal, combines with it, and forms carbonic oxide; and in this way the products of the perfect oxidation of one part of the fuel carry off, imperfectly oxidised, another portion of it.

The imperfect oxidation of fuel produces two bad results—firstly, a waste of heat; secondly, the vitiation of the air. Carbonic oxide is a highly poisonous compound; and, as it does not contribute to the growth of plants, its presence in the atmosphere subserves no useful purpose.

Dense fuels—such as, for example, anthracite, or smokeless coal

—produce during their combustion more carbonic oxide than lighter fuels—wood and peat more especially. Carbonic oxide is at least four times more poisonous than carbonic acid. The headache, giddiness, and severer symptoms produced by the gases evolved from stoves, braziers, and chafing-dishes appear to be due much more to the influence of carbonic oxide than of carbonic acid.

The cause that produces carbonic oxide in furnaces also gives rise to smoke from them. On an average nearly one per cent. of bituminous, or flaming coal passes off in the form of soot—a mixture of tar, charcoal, coal ashes, and a few other substances. Smoke, hanging like a pall over a town, acts injuriously by partially excluding light; and air containing sooty particles is likely to affect the respiratory organs. Whether or not the more serious affections of the breathing organs are produced by the respiration of smoky air, exact evidence is wanted to determine.

The evolution of smoke and the production of carbonic oxide might be considerably lessened by careful stoking. If too much air be admitted, the temperature of the fire is lowered below the point of perfect combustion; but the great and usual defect is a deficiency of air. Coal contains carbon and hydrogen, and when highly heated yields carburetted hydrogen gas. When a fire is lighted, coal gas begins to be produced, and the hydrogen of it is oxidised. The carbon also, if there be abundance of air, is burned; but if the supply of oxygen be inadequate, part of the carbon, or charcoal, is converted either into carbonic oxide or smoke, or both. To prevent smoke, the fire should be maintained at a high and nearly equable temperature, so that the gases may not be cooled. The fuel should be added frequently and in small quantities and pieces, and care must be taken not to choke the furnace. Fresh fuel should be placed at the door of the furnace, the red coal being pushed back. A common mistake is to do exactly the reverse, whereby the fresh coal is, to a great extent, converted into unoxidised gases, which escape up the chimney. The openings through which the air is admitted to all places where fuel is burned should be kept free from cinders and ashes.

There are several kinds of furnaces which are said to emit no smoke, but the best of them permit unoxidised matters to escape. Jucke's chain furnace is very costly, but it effects great economy of fuel. The fire bars consist of a series of "endless" chains, set in motion by means of two wheels furnished with teeth. A hopper is placed in front of the furnace, and from it the fuel is delivered through an opening, the size of which regulates the supply of fuel to the furnace. By these means the supply of fuel is regular, and every part of it is equably exposed to the air. Hill's furnace is intended to prevent smoke, by mixing highly-heated air with the unburnt gases as they pass from the furnace to the flue. Prideaux's smoke-prevention furnace is mentioned favourably by several authorities on this subject. The 108th section of the

Towns Improvement Clauses Act (1847) enables municipal authorities to prosecute those who permit black smoke to escape from the chimneys of manufactories.

In some parts of England chemical and smelting works are so numerous that the gases evolved from them have almost annihilated the vegetation of considerable tracts of country. In the spring of 1874 I was employed by the Chamber of Agriculture of Lancashire to inspect the manufacturing districts of that county—Widness, Warrington, St. Helens, &c.—and to deliver a lecture upon the results of my observations at Newton-le-Willows. I found many tracts of land, several thousands of acres in extent, so much affected by the noxious vapours, and gases, and smoke that they only produced very poor crops. I found that on some farms close to alkali and copper smelting works whole crops had utterly failed. For miles not a healthy tree was visible. In some places the trees and bushes were utterly destroyed, blackened stumps alone remaining of them. I readily detected acid liquid on the leaves of such plants—hardy bushes—as had survived. Cows kept near these works were, I was informed, peculiarly liable to abort; and the condition of all kinds of stock was very unhealthy. On close inquiry I found that the death rate was very high for semi-rural districts.

The factories which give forth the gases that have effected so much injury to vegetation and to health in Lancashire and other places are salt-cake, soda ash, copper smelting,* and glass works. They evolve sulphur acids, hydrochloric acid, and metallic vapours, besides enormous volumes of black smoke. The numerous collieries, too, blacken the atmosphere with volumes of smoke.

The Alkali Nuisance Prevention Act was amended in 1874, and it now includes sections prohibiting the escapement of sulphurous acids and other deleterious gases from alkali and acid works. The chief inspector of alkali works is Dr. Angus Smith, of Manchester, who, as well as one of the Assistant Inspectors, Dr. Blatherwick, periodically visit Ireland to examine into the condition of the chemical works. Although alkali and acid factories are placed under the supervision of special inspectors, they are not outside the jurisdiction of the local sanitary authorities. Should they produce a nuisance, either by permitting the escape of black smoke or of an undue amount of acid vapours or gases, their owners can be proceeded against under the common sanitary laws.

CHAPTER XIII.

METEOROLOGY AND TOPOGRAPHY IN RELATION TO HEALTH.

The highest inhabited part of the world is the Buddhist Convent of Hanle in Thibet, 10,000 feet above the level of the sea. Mr. Glaisher ascended in a balloon to a height of 38,000 feet, at which altitude his heart fluttered rather than beat, and his hands were benumbed. The huge condor may be observed flying 500 feet higher than the summits of the Andes, five miles above the sea level.

The physical condition of the atmosphere is a point of considerable hygienic importance. At great heights above the surface of the ocean the pressure on the body is much diminished, the circulating fluid is impelled with greater rapidity through the vessels, and the respirations are proportionately increased. A pleasurable excitement is experienced, and the desire for muscular exercises is exalted. The advantages of mountain air are many. The light is less obscured in passing through it; the quantity of moisture in it is small; there is the merest trace of organic matter; and no infusorial animals occur in it. The air of upland regions—say from 3,000 to 7,000 feet elevation—has been found most useful in the treatment of dyspepsia, anæmia, or wasting of the body, gout, and scrofula. At a height of from 5,000 to 7,000 feet rheumatic patients often find their painful malady ameliorated. Inflammation of the lungs and acute bronchitis do not appear to be removed by mountain air. There is some doubt as to the efficacy of mountain air in the treatment of pulmonary consumption; but it is remarkable that persons who live in very elevated regions rarely suffer from this disease. Malarious fever is seldom, if ever, contracted at great heights.

According to Toner, the greatest number of deaths from phthisis in the United States occur in the parts least elevated, and in which there is much water. Perhaps as the cold in the United States is intense in winter that it is the conjoined influence of cold and damp that is productive of thoracic complaints. In some moist but mild climates pulmonary consumption is rare. Tubercular diseases are said to occur very rarely in the highest parts of the inhabited Alps.

Dr. M'Nab¹ has directed attention to the remarkable immunity from pulmonary phthisis enjoyed by the Highlanders of Scotland, and more especially by the natives of the Hebrides. In one district inhabited by 2,500 persons there were but five well defined cases of pulmonary consumption during a period of nine years. In the peninsula of Dingle the infrequency of phthisis is equally remarkable.

¹ The Immunity from Consumption in the Hebrides. By John M'Nab, M.D. Edinburgh, 1869.

Although it is obvious that the temperature of the air is a point of hygienic importance, the relation between heat and disease has been by no means satisfactorily determined. There is a general opinion that cold climates are healthy, and that very hot ones are the reverse; but it is probable that the insalubrious condition of many hot countries is due to malarious exhalations, and not to the high temperature of the air. The natives of the British Islands appear to thrive better in countries as cold or colder than their own than in hot climates. The Canadians and New Zealanders of British origin are certainly a hardier race than the West Indian Creoles of pure British descent. In tropical climates in the East, Europeans degenerate so rapidly that in the course of three or four generations they generally die out, unless they intermarry with the natives. It is the opinion of some authorities that Europeans are capable of as effectively working both mind and body in tropical climates as in their native countries; but there is evidence enough to prove that great and prolonged mental and physical vigour is not promoted by air at 100° in the shade.

Extreme cold is not common in these islands, the thermometer seldom falling below the freezing point. In Ireland the mean temperature in winter is 41.5° ; in summer, 60° ; average, 50° . In the extreme north of the island the mean annual temperature is 3° lower than in the extreme south. The mean spring temperature at Queenstown, county of Cork, is 50° , which is about the highest in Great Britain at that season. The mean annual temperature of England is 49.5° ; of Ireland, 50° ; of Scotland, 47.5° ; of Guernsey, 50.2° ; London, 51.3° ; Isle of Man, 47.8° ; Marseilles, 59.5° ; Toulon, 62° ; Paris, 51.2° ; Rome, 59° ; Palermo, 62° ; Berlin, 46.5° ; Vienna, 49.5° ; Trieste, 55° ; Calcutta, 79° ; Madras, 83° ; Bombay, 84° ; Neilgherries, India (7,300 feet elevation), 57° ; Archangel, 12° ; Melville Island, 1.7° ; Arctic regions, nearly zero. The highest annual temperature— 90.5° —is at Massava, near the Red Sea, and on the Nile, in Lower Nubia. The greatest temperature (145°) has been observed in India; the lowest, 92° below zero, in 55° N. lat.

The temperature of the sea varies (except when frozen) from 32° to 81.5° ; that of the North Sea is 50° ; North Atlantic, between 60° S. and 50° N., 71.5° ; South Atlantic, between 50° S. and 50° N., 66.7° ; North Pacific, 69.9° ; South Pacific, 67.7° ; Indian Ocean, 69.3° ; Black Sea, 56.8° ; Western Mediterranean, 69° ; Eastern Mediterranean, 69° . The highest temperature— 94° —was observed in the Red Sea, near Aden; the greatest mean annual temperature, namely 84.5° , to the east of New Guinea. The mean annual temperature of the ocean near Great Britain and Ireland is about 52° . A warm current of water, familiarly known as the Gulf Stream, flows north-eastwards from the Gulf of Mexico, and reaches beyond the Orkneys. It carries with it a large store of heat from the warm southern latitudes, which, gradually escaping into the air, increases the temperature of the

British Islands by perhaps 25° in winter. A current of cold water from the icy seas of the north flows southwards, bathing on its way the east coast of North America, and lowering its temperature many degrees.

Sudden and great changes of temperature rarely fail to produce disease; therefore equable climates are—other conditions being equal—more healthy than those in which the range of temperature during a season is extreme. The range of temperature is greatest in dry climates and temperate regions, and least in very high latitudes, in the tropics, and in wet climates. The west and south-west part of these islands have a more equable temperature than the north-east and south-east parts. Low temperature in the British islands produces a high death-rate. In the early part of the year 1867 the extreme cold that prevailed nearly doubled the death-rate in London and many other places. Old people are the chief sufferers when the cold is excessive.

Dr. Grimshaw states:—

“1st. That an increase in the moisture of the atmosphere favours an increase in typhus, and *vice versa*.

2nd. That an increase of temperature favours an increase of typhus, and *vice versa*.

3rd. That the two previous conditions combined are *most* favourable to an increase in typhus, and *vice versa*.

5th. That when cold and moisture combine, the former tends to diminish the influence of the latter.

It will thus be seen that an increase of moisture, other things being equal, is the atmospheric change most favourable to an increase of typhus; but that when to this is added an increase of temperature, we have *the* most favourable atmospheric conditions for the spread of fever. It would also appear that dryness and cold (the latter particularly) have an influence contrary to the spread of fever. I do not mean to state that there are no exceptions to the rules just laid down, but the exceptions, which are few, and by no means well marked, are easily accounted for by other disturbing causes.”

Dr. F. C. Faye, of Christiana, states that most epidemics of cholera have occurred in warm weather, because exhalations from the soil are most abundant; whilst continued heavy rain have an opposite effect—probably by washing away the contagion of the disease and the matters—filth in which it is usually found. Dr. J. W. Moore has shown that the cholera in Dublin was checked by low temperature, a diminution of barometrical pressure and strong winds. In the United States hot weather produces a great increase in diarrhoea, especially amongst children.

In London the curve of mortality rises with the temperature in summer and with the fall of the temperature in winter; but whilst in summer the higher mortality produced from heat is alone caused by the excess in the deaths of children under five years of age, in winter the high curve of mortality caused by low temperatures is

produced by increase of deaths amongst persons of all ages. According to Dr. Archer Mitchell and Mr. Alexander Buchan the curves of maximum mortality from different diseases are caused by

<i>Nature of weather.</i>	<i>Maximum Mortality.</i>
Cold	Catarrhs and Pneumonia, Bronchitis, Asthma.
Cold and Dry ...	Brain Diseases, Convulsions, Whooping Cough.
Cold and Moist ...	Diphtheria, Searlatina, Measles, Croup, Rheumatism, Heart Disease.
Warm and Dry ...	Small-pox, Suicides.
Warm and Moist ...	Cholera, Dysentery, Diarrhœa.

According to Drs. Ballard and J. W. Moore a temperature above 59° or below 42° Fah. checks the spread of measles, a disease which appears to be most prevalent in the second and third quarters of the year.

The air of marshes produces not merely its characteristic diseases, intermittent and remittent fevers, but also dysentery. The enormous amount of 8 grains of organic matter has been found in 1,000 cubic feet of the air of marshes. Malarious diseases produce their greatest effects when, it is stated, the atmosphere is nearly saturated with watery vapour.

The quantity of moisture in the atmosphere depends to a great extent upon temperature. Air at 32° can perfectly dissolve the 160th part of its own weight, at 59° the 60th part, and at 86° the 40th part of moisture. Every increase of 27° of temperature in air doubles its capacity for holding water in solution. If the temperature of air saturated with watery vapour be lowered even one degree, sensible moisture is produced. What is termed the *dew point* is simply the temperature just above that at which air begins to precipitate its watery constituent. The number 100 being taken to represent air saturated with moisture, percentages may be used to express the relative humidity of the atmosphere. Twenty-nine is the lowest degree of relative humidity ever observed in these islands; but in African deserts it has fallen as low as ten. The average degree of humidity in London during the ten years ended 31st of December, 1869, was seventy-nine. In elevated regions and in high latitudes the amount of moisture in the air is usually very small, and the atmosphere is therefore clear and bright. The evaporation of water from the animal body is retarded when the air is loaded with watery vapour, and is much accelerated by hot, dry winds; in both cases discomfort at least is experienced by most persons.

A relative humidity of between seventy and eighty is undoubtedly the most pleasant, and is probably the most healthful. The east wind in spring is very dry, and robs the body of much of its moisture. Many persons feel very cold when exposed to this wind, even when the thermometer registers sixty degrees. In chronic diseases of the lungs very moist air has been found beneficial; and in the humid atmosphere of the peninsula of Dingle, in the county

of Kerry, phthisis, or pulmonary consumption, is a rare complaint. Malarious¹ diseases are most prevalent in very damp atmospheres. The inhabitants of cities enjoy immunity from miasmata. Though malarious disease may approach to the actual boundaries of a town, it never penetrates to the interior portions of it. The products of the combustion of fuel which are so largely present in the air of towns may probably in some way destroy the poison of miasma. Bogs though generally damp do not produce miasmata, but they cause other malignant catarrhs.

The rainfall of a country probably affects in some way the health of its inhabitants; but we have not sufficient data to enable us to speak positively on this subject. In parts of Peru, and in some of the deserts of Asia and Africa, no rain ever descends. On the Khasya Hills, 200 miles from the Bay of Bengal, the enormous quantity of 600 inches of rain falls annually; on the West Ghauts, 263 inches; Singapore, 90 inches; Barbadoes, 72 inches; Bahamas, 52 inches; North America, 20 inches in California, increasing northwards until at Sitka, in North-west America, it reaches 90 inches. In European countries the wettest are those that lie to the west and north-west. In Germany the rainfall is not more than 20 inches; in France, 30 inches; in the east of England it is about 24 inches; but in the west, on the plains, it is above 35. The average rainfall in London during the last ten years has been about 24 inches. At Dublin, about 30 inches fall annually; and near the west coast of Ireland, from 38 to 45 inches. In the mountainous regions of the western and north-western parts of these islands the rainfall often exceeds 100 inches, and is sometimes even 150 inches per annum.

The rainfall in some countries is distributed over a large proportion of the year; in other regions the rain descends only during a small number of days. In Great Britain and Ireland the number of rainy days varies from more than 250 in the north-west and western parts to 150 in some of the eastern districts. The average annual number of wet days in London is 163, distributed nearly equably throughout the four seasons. In some of the Continental districts frequented by the invalid the number of rainy days is under 60, thus permitting almost continuous out-door exercise in, or, at least, exposure to, the pure open air.

In cold countries, woods and forests, by impeding the evaporation of water from the surface soil and obstructing the passage of the sun's rays, render the climate colder and moister than it would be if there were no trees there. In hot countries, on the contrary, vegetation serves to cool and moisten the atmosphere. Trees in moderate numbers are, on the whole, useful in Ireland; they serve to protect houses from strong winds, and they are a good shelter against currents of malarious air, though the latter are not prevalent in this country. Trees in common with all other plants,

¹ *Malaria* is an Italian term applied to the poisonous exhalations from the marshy soils of parts of Italy.

except parasites, purify in some measures the air by removing from it carbonic acid, and replacing that poisonous gas with oxygen.

The late Dr. W. D. Moore in a translation¹ of various papers from *Weitschrift fur Biologie*, in reference to the connection between typhoid and the height of the underground water, states the conclusions in reference to this point arrived at by Buhl:—

1. The variation which takes place in the mortality from typhoid in Munich necessitates the assumption of a coöperating cause, sometimes assisting, sometimes counteracting, the specific cause of typhoid fever, and which must be considered as its quantitative side, as the basis of the extension and force of the disease.

2. Of all elements in Munich accessible to investigation, the oscillations in the underground water especially exhibit relations, unmistakably indicating their connexion with the spread and violence of typhoid fever.

3. So long as the underground water continues to rise, the number of fatal cases of typhoid fever steadily falls, and *vice versa*.

Density of population has a very great influence on the state of the public health. Dr. Gairdner has investigated the relation between the density of the population and mortality in England. The following table shows the results of his inquiries:—

Population on square mile.	Death per 100 of the population.
56	15
106	16
144	71
149	18
182	19
202	20
220	21
324	22
485	23
1,216	24
1,262	25
2,064	26
2,900	27 and upwards.

The reports of Mr. Chadwick on the condition of the labouring classes in 1842, the report of the Health of Towns Commission, 1844, and the annual reports of the three registrars-general of the United Kingdom show clearly that every increase in the density of the population is attended with an increase in the death rate, and a diminution of the vital powers of the people. The French sanitarians have long since directed attention to the fact that the most vigorous and best developed recruits were those furnished by the rural districts. I have noticed myself that the great majority of powerful men employed as porters by the brewers, corn merchants, and steam-packet companies are country born and bred.

The reports of Mr. Simon, medical officer of the Privy Council, England, show that the death rate from phthisis (as well as from other causes) has greatly decreased in many towns in consequence of drainage operations. The following table shows the general

¹ *The Dublin Journal of Medical Science*, August, 1869.

improvement which has taken place in the health of 24 towns by the drainage operations.

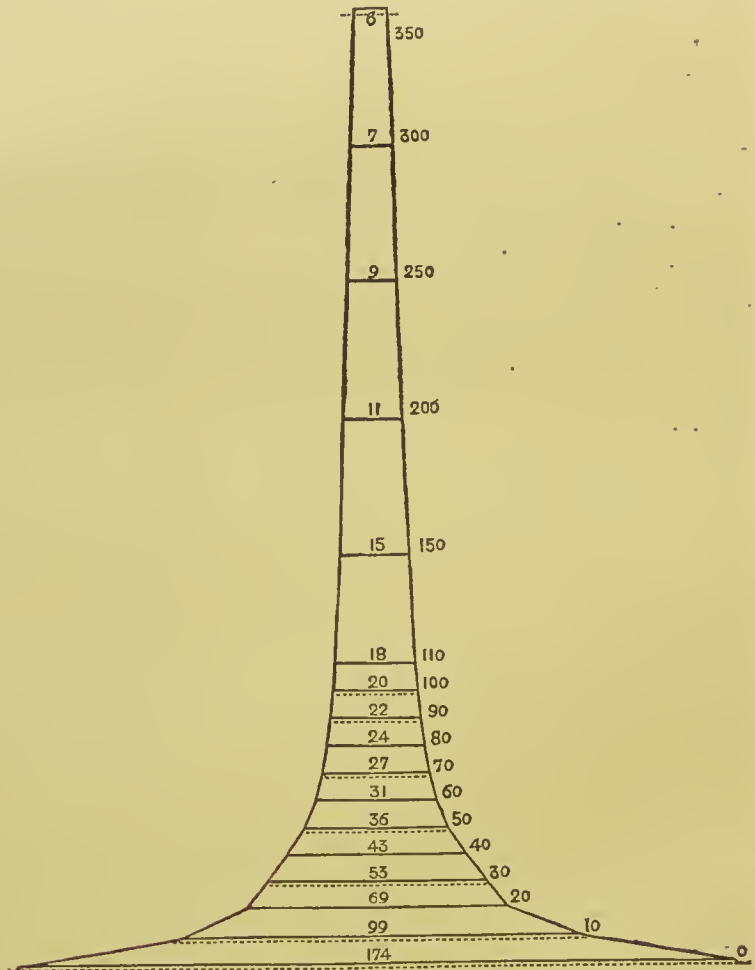
TABLE SHOWING IMPROVEMENT OF THE PUBLIC HEALTH BY
SANITARY WORK.

Towns.	Periods for which the Death-rates are compared.		DEATH-RATES PER ANNUM, TOTAL AND PARTICULAR, PER 10,000 OF GENERAL POPULATION, FOR EACH OF THE COMPARED PERIODS.												
			A		B		C		D		E		F		
			General Death-rates.	General Death-rates after excluding Small-pox and other Infantine Epidemics.	Typhoid Fever.	Diarrhoea, excluding Cholera so called	Cholera in each of the three Epidemics.	Phthisis.							
	Before the Works.	After the Works.	Before the Works.	After the Works.	Before the Works.	After the Works.	Before the Works.	After the Works.	1848—49.	1854.	1866.	Before the Works.	After the Works.		
Bristol,	1847—51	1862—65	245½	242	215	205¾	10	6½	10½	9½	82	11	1½	31	25½
Leicester,	1845—51	1862—64	264	252	236¾	225¾	14¾	7½	16	19½	1	10	20	43½	29½
Merthyr,	1845—55	1862—65	332	262	292½	221½	21½	8½	11½	6½	267	84	20	38½	34½
Cheltenham,	1845—57	1860—65	194	185	182	172	8	4½	8½	7	...	...	...	28½	21½
Cardiff,	1847—54	1859—66	332	226	294	191½	17½	10½	17½	4½	208	66	15½	34½	28½
Croydon,	1845—50	1857—64	237	190	207	178½	15	5½	10	7	27	21	2	?	?
Carlisle,	1845—53	1858—64	284	261	244	225	10	9	11½	12½	22	6	...	32	35½
Macclesfield,	1845—52	1857—64	298	237	263½	217½	14½	8½	11½	11	9	1	...	51½	35½
Newport,	1845—49	1860—65	318	216½	275	187½	16½	10½	11	6½	112	10	1½	37	25
Dover,	1843—53	1857—65	225½	209	203	187	14	9	9½	7	40	10	4½	26½	21½
Warwick,	1845—55	1859—64	227	210	209½	191½	19	9	5½	8	10½	...	...	40	32½
Banbury,	1845—53	1857—64	234	205	214	184	16	8½	11½	5½	2	1½	...	26½	15½
Penzance,	1843—50	1856—65	221	222	197½	200½	7½	8	5½	9½	...	...	...	30½	29
Salisbury,	1844—52	1857—64	275	219	253½	198½	7½	1½	6½	2½	180	14½	...	44½	22½
Chelmsford,	1843—52	1855—65	196½	215	180	187½	12	12½	7	8	4	...	...	32½	32½
Ely,	1845—52	1859—64	228	205½	210	186½	10½	4½	3½	4½	...	22	...	31	16½
Rugby,	1845—51	1855—64	191	186	164	164½	10	9	2½	7½	...	...	...	28½	16½
Penrith,	1845—52	1856—64	253½	250	235½	230½	10	4½	3½	4½	9½	2½	...	39½	37½
Stratford,	1845—53	1860—64	217	202	212½	178	12½	4	11½	5½	...	...	...	26½	26½
Alnwick,	1845—51	1856—64	262	247	240	221½	13½	8½	7	4	205	...	...	28½	33
Bryn-mawr,	1843—52	1856—65	273½	232½	232	209	23½	10½	5	4½	100	...	...	28½	30
Worthing,	1843—52	1857—65	155	153	139	136½	7½	9½	4½	5½	...	...	...	30½	19½
Morpeth,	1845—52	1856—64	262	247	234	225	16½	10	8½	14½	14	11½	...	30½	28
Ashby,	1845—51	1855—64	216	202½	213	114	13½	5½	4	8½	...	...	...	25½	31½

In many of these towns the diminution of the mortality from cholera during its successive invasions is unquestionably due to improved drainage and water supplies. The diminution of thoracic complaints seems due to the drying of the soils, which, as a general rule, followed the construction of main sewers. At Salisbury fatal cases of pulmonary phthisis have been reduced to the extent of 49 per cent.; at Rugby, 43 per cent.; and at Worthing, 36 per cent. In those towns in which no decrease in the cases of phthisis has been observed, the disease, with but few exceptions, had not been excessive before the drainage operations, probably, in most cases, because the subsoil was naturally dry. Measles,

scarlatina, and whooping cough do not seem to be much affected by drainage works.

Heavy impertransible clay soils are unfavourable to persons disposed to rheumatic and tubercular complaints; whilst gravels and sands being loose and porous, though not productive of the above complaints, are dangerous when cholera and typhoid are epidemics. The granite and other primary rock districts are stated to be healthier, as are also the sandstone, limestone, dolomite, and chalk districts; whilst the dwellers on the drifts or alluvial soils are believed to be more liable to disease. Ponds, small lakes, slow moving rivers, situated in valleys, are most likely injurious to the occupants of houses close to their banks.



Low-lying places are more liable to be ravaged by certain contagious diseases, such as, for example, Asiatic cholera. Dr. Farr directed attention strongly to this point in his report on the epidemic of cholera in London, 1849. The diagram shows the number of deaths per 10,000 of the inhabitants which occurred at the different heights above the level of the Thames. Those

who lived at the level of the river were peculiarly exposed to the contagion of this frightful malady, the deaths amongst them having amounted to 174 per 10,000 living. On the other hand, at a height of 350 feet above the river level the deaths were only 6 per 10,000. Farr, however, pointed out the important fact that the greatest elevation was no protection against cholera.

Mapother has shown (*Lectures on Health*, p. 487) that three-fourths of the deaths that occurred in Dublin during the epidemic of cholera in 1866 took place on or close to the sites of ancient watercourses, now, for the most part, converted into sewers or filled up with mud. It is probable that the reason why cholera spreads most through low-lying districts is, that in such situations drainage being difficult, is often imperfectly carried out. In a low-lying place, well sewered, cholera would probably be less likely to spread than it would at a greater elevation with imperfect sewerage. It is not merely the death rate from zymotic diseases that is diminished by the proper drainage of the soil; for, as already shown, thoracic complaints are lessened by it, and in some clearly ascertained instances to a remarkable extent.

Pettenkofer remarks that organic matter decays much more rapidly in loose soils than in stiff clays. The Belgian chemist, Louis Crêteur, had to disinfect the pits which contained the bodies of those slain at and near Sedan. He found that in the rubble, chalk, and other light soils, the bodies had mouldered away, but they were in a wonderful state of preservation in the heavy adhesive clays. The more porous the soil is the more rapidly organic matter decays therein, and the more readily the circulation of air and water proceeds. Such a soil is, therefore, the most abundantly inhabited by the lower forms of life. Pettenkofer shows that in these loose soils, and, indeed, in the earth generally, there is a large quantity of air usually richer in carbonic acid than the air above the ground, and that the underground-air is affected by the currents, temperature, &c., of the above ground-air. A strong wind playing upon the surface of the ground, outside a house, will sometimes force the gases contained in the ground into the interior of the adjacent houses. In this way, according to Pettenkofer, underground-air may be the means of introducing the contagia of certain zymotics into our dwellings.

Although disease is not confined to any season, there are certain periods of the year during which many maladies somewhat regularly attain their maximum intensity. Scarletina is most prevalent during the December quarter. According to Dr. J. W. Moore, it produces in Dublin its maximum mortality in the 46th and its minimum in the 24th week of the year. Typhus is most prevalent in January and February, least so in June and July. Typhoid fever prevails more in summer than in winter. Whooping cough is most common in the winter and spring; and it is remarkable that a sudden rise of temperature increases at first this disease, but subsequently diminishes it. Diarrhœa and dysentery attack people more

frequently in autumn, least frequently in spring; whilst in the latter season rheumatic affections are most general. The mortality from small-pox is greatest during winter and spring. Out of 182 outbreaks of cerebro-spinal meningitis in Europe, enumerated by Simon, 24 occurred in October and November, 46 in December and January, 48 in February and March, 30 in April and May, 24 in June and July, and 10 in August and September. Asiatic cholera is essentially a summer disease, though an occasional outbreak of it in winter has taken place. The mortality from cholera makes its highest point in these countries in August or September.

Out of 29,308 deaths from diarrhoea recorded during sixteen years in London, two-fifths occurred during the thirtieth to the thirty-seventh week of the year inclusive. The greatest mortality was in the thirty-second or thirty-third, the least in the fourteenth week. The percentage of deaths from diarrhoea was 42 in summer, 40 in autumn, 10 in winter, 8 in spring.

In winter thoracic complaints—bronchitis, pneumonia, phthisis, &c.—are most prevalent, and are the chief factors in producing mortality. Dr. E. Smith has analysed the vital statistics of London for the period 1850 to 1854 (non-epidemic years), inclusive, and has ascertained the amount of mortality occasioned by each of the most important diseases in each quarter of those years. From his inquiries he has constructed the following interesting table:—

TABLE SHOWING THE EXCESS OR DEFECT IN THE PREVALENCE OF CERTAIN DISEASES AT EACH SEASON OF THE YEAR FROM THE AMOUNT WHICH WOULD HAVE OCCURRED HAD THE MORTALITY BEEN EQUALLY DISTRIBUTED THROUGH THE YEAR.

Disease.	Vital Changes.			
	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.
	Maximum.	Maximum and Decreasing.	Decreasing and Minimum.	Minimum and Increasing.
Diarrhoea ...	— 15.2	— 14.5	+ 36.4	— 6.9
Enteritis ...	— 1.7	+ 2.9	+ 4.0	+ 0.2
Gastritis ...	— 2.4	+ 1.4	+ 4.4	— 4.6
Nephritis ...	+ 2.3	— 0.5	+ 3.4	— 0.8
Peritonitis ...	+ 0.7	+ 4.6	— 4.1	— 1.4
Pleuritis ...	+ 5.0	+ 5.0	— 6.2	— 0.3
Bronchitis ...	+ 12.9	— 1.9	— 14.0	+ 2.8
Pneumonia ...	+ 4.8	+ 1.1	— 10.7	+ 6.7
Pericarditis ...	+ 4.5	+ 0.3	— 6.4	+ 1.5
Cephalitis ...	+ 1.6	+ 0.5	—	— 2.3
Convulsion ...	+ 2.7	— 0.6	— 2.1	— 0.2
Apoplexy ...	+ 2.6	— 1.7	— 2.1	+ 1.2
Epilepsy ...	+ 2.4	— 3.7	— 2.3	+ 3.0
Small-pox ...	+ 1.0	+ 1.4	— 4.0	+ 1.3
Measles ...	— 1.1	+ 6.4	— 5.8	— 0.1
Scarlatina ...	— 8.3	— 4.6	— 0.2	+ 12.5
Typhus ...	— 2.1	— 2.0	+ 0.5	+ 4.2

CHAPTER XIV.

CONTAGION.

Most of the diseases which affect mankind arise spontaneously in each individual, and are not communicable from one person to another; but some maladies are propagated from the sick to the healthy. Any one completely isolated—that is, separated from contact or communication of any kind with all other persons—may still contract bronchitis, inflammation of the lungs, or paralysis; but a man so circumstanced would not be liable to small-pox, Asiatic cholera, or scarlatina. Diseases that arise spontaneously are termed *sporadic*—a term derived from the Greek word, *sporadikos*, separate or distinct; those which are acquired by contact with the person of, or emanations from, the sick are called *contagious*—from the Latin word, *contagio*, touch, or contact. Contagious diseases are in general epidemics¹—that is, they simultaneously attack a large number of persons: but it is probable that a few non-contagious maladies are occasionally epidemic; in this class influenza is placed by some writers. The terms “contagious” and “infectious” are now generally used indifferently, and are equivalent to the expressive word *catching*. The term *endemic*² is restricted to certain diseases, the range of which is confined to particular localities. Goitre, for example, is endemic in the Swiss valleys, *malaria* in the Roman plains, and ague in the marshy districts of India. All the diseases which appear in the epidemic form, or which are supposed to be contagious, are now generally placed in a group, and termed *zymotic*.³ Diseases of the same general nature, which affect the lower animals, are called *epizootics*.⁴

In the present condition of medical science it seems rational to assume that the direct cause of every kind of zymotic disease is a distinct organised body, or entity, and not mere abnormal conditions of the ordinary ingredients of the air or soil. The more important zymotic diseases are small-pox (their type), typhus fever, ⁵typhoid fever, scarlatina, diphtheria, measles, whooping-cough, Asiatic cholera, and perhaps diarrhoea. It is a singular fact, that persons who have once suffered from a zymotic disease

¹ Greek *epi*, on, and *demos*, the people.

² Greek, *en*, among, and *demos*, the people.

³ Greek, *Zyme*, ferment. ⁴ Greek, *epi*, on, and *zoon*, an animal.

⁵ In a masterly essay (*Typhoid Fever, its Nature, Mode of Spreading, and Prevention*, by William Budd, M.D., F.R.S., London: Longmans, Green & Co., 1873), Dr. Budd has to my mind conclusively proved that enteric fever is a self propagating disease, and that it does not originate sporadically.

rarely contract the same malady a second time. It is supposed that the blood of every person contains a peculiar principle, on which the virus of the disease alone subsists, so to speak, and that when this substance becomes exhausted during an attack of the malady, it is not again renewed. This hypothesis is not supported by any proofs, and is far from satisfactory, but no more probable theory has been suggested. Another fact in relation to zymotics has also been established, and that is, that all persons are not equally susceptible to their influence. Many medical men have been for years engaged in the treatment of fever, and yet have escaped that malady, while thousands of persons have caught the disease at their first contact with a fever patient. *Susceptibility* to contract zymotic diseases is produced by intemperance, by insufficient nutriment, by the habitual respiration of bad air—in a word, by every cause that lowers the vital powers.

What is it that we try to destroy when we generate chlorine gas in a room which had been tenanted by a small-pox patient? Is it a gas, or a vapour, or an abnormal condition of one or more of the ordinary constituents of the atmosphere? If the cause of the disease lie in an abnormal condition of the atmosphere—in the occurrence of a “pandemic wave” in that fluid—the disinfection of the air of a particular room would be useless, because, where ordinary ventilation is adopted, the purely gaseous contents of an apartment are wholly renewed many times in an hour. What, therefore, would be the use of disinfecting a room if the atmosphere, on entering it, be already tainted! There are many physicians who believe that epidemic diseases are caused by an abnormal condition of the atmosphere; but even those, or at least the majority of them, admit that they may be propagated directly from the sick to the healthy. Who can deny that the matter taken from a small-pox pustule will produce small-pox, if introduced into the blood of a healthy man? It is clear that in this case a palpable agent produces the disease, and the observation of mankind during countless ages has incontrovertibly established the fact that some diseases are communicated from individual to individual. If cholera, small-pox, rinderpest, and other zymotic and epizöotic diseases are caused by abnormal atmospheric conditions, why is it that they speed along the highways of commerce, that they spread most rapidly as the density of population increases, and that they prevail most in those places where least attention is paid to the removal of organic filth? If the amount of carbonic acid in the atmosphere were increased from its normal proportion of 4 parts in 10,000 parts of atmospheric air to 4 parts in 100, serious disease would be the result; but it would afflict all classes alike, and would ravage the country regions equally with the urban districts.

A careful examination of acknowledged facts relative to nearly all the more important epidemic diseases fully justify the belief that each is produced by the introduction of a *materies morbi*, or

germ, or virus, or some palpable substance from the bodies of the sick into those of the healthy; and by that way alone. This view of the mode of propagation of zymotic diseases is, perhaps, most conclusively proved by admitted facts in relation to two contagious diseases—namely, *scabies*, or common itch, and syphilis. Is either of these diseases ever produced by atmospheric causes? Who would be believed if he stated that he caught syphilis from the air? True, we have not isolated the actual poison of syphilis; but we know that an extremely minute quantity of a liquid, containing solid particles, includes this poison; and it is further clearly established that sporadic cases of syphilis do not occur in our time. With respect to common itch, it was proved long ago that the disease was produced by a small insect, and that it was propagated from individual to individual. If all the *acari scabiei* and their *ova* now in existence were destroyed there would be an end of the itch for ever. Huxley, who is by no means an ultra vitalist, admits that there is no evidence of spontaneous generation occurring in our time.

The itch is a good example for the purpose of illustrating the nature of contagion. The *materies morbi* is easily seen; it is an entity, it possesses reproductive powers—begetting its own kind, and it is never found except in the bodies of higher animals. The non-contagionists must admit that at least in the case of this disease the theory of the contagionists is proved to demonstration, and simply because the virus of the disease is so large as to be almost seen by the unassisted eye.

The weight of evidence and of opinion too, in the case, at least, of epidemiologists, is in favour of the germ theory of zymotic disease; but most important problems relative to the intimate nature of the different contagia and to their co-relation are still to be determined. In general the contagious matter appears to be excessively minute. Chauveau (*Comptes Rendus*, October 19th, 1868) diluted the liquid taken from the pustules of sheep-pox with 10,000 parts of water, and found that it still retained its power of producing small-pox in the sheep. Vaccine matter from man may be diluted with ten times its weight of water without losing its contagious property to a sensible extent; but if diluted with 500 parts, it becomes perfectly inactive. Hence it is evident that the contagious liquid of sheep-pox is many times more powerful than vaccine, probably because it contains a larger number of the actual particles, or germs, that produce disease. These germs have been carefully sought for by such eminent pathologists and microscopists as Béchamp, Estor, Cohn, Nägeli, Hallier, Chauveau, Sanderson, De Barry, Thomé, Klob, Hoppe-Seyler, Virchow, Poulet, Meignir, Zigri, Davaine, Brauell, Vander Corput, and Lionel Beale. On the whole, the results of the investigations of these inquirers (all believers in the germ theory of disease) have not been barren. Bacteria have been found by some of these in the blood of oxen and horses affected with typhoid fever, and carbun-

cular diseases, of dogs suffering from ileo-typhus, of oxen affected with pleuro-pneumonia, and of man in some cases of scarlatina and typhoid. Poulet states that he found bacteria in the breath of children labouring under whooping cough. It is shown that vaccine contains in suspension minute quantities of two kinds of solid particles—*leucocytes* (which resemble pus corpuscles), and smaller particles not exceeding the $\frac{1}{20000}$ of an inch in diameter. The leucocytes may be easily separated from the other particles and the serum; and they are found to be perfectly inactive. The vaccine property must, therefore, reside either in the small particles or the clear serum. By means of the diffusion apparatus, Burdon-Sanderson and Chauveau have succeeded in obtaining the serum free from the small particles, but failed to produce vaccinia with it either in man or in the ox. These important and accurately conducted experiments prove that the actual cause of cow-pox, and inferentially of other kinds of small-pox, is a minute solid and insoluble body.

In liquids containing decomposing organic matter we usually find large numbers of minute living beings in a state of great activity. Some are spheroidal, others resemble knotted rods. The former are termed monads: *micrococci* or *microspores*; the latter are called *bacteria*, *zooglæa*, *vibriones*, &c. The micrococci are each about $\frac{1}{20000}$ of an inch in diameter; they move about with great rapidity, and multiply by cell division. When they elongate into rods, they acquire a peculiar vibratory movement, which has led them to be termed vibriones. Béchamp and Sanderson include under the generic name, *mycrozyme*, both the spheroid particles and the rod-like bodies into which they are developed. No doubt there are numerous varieties of microzymes, but the minuteness of these infusorial animals renders it extremely difficult to discriminate between the different species.

Dr. Burdon Sanderson has laboriously investigated the intimate nature of contagion, and his valuable papers on the subject, published in the appendices to the annual reports of the Medical Office of the Privy Council for 1869 and 1870, will well repay perusal. There appears to be a somewhat general notion amongst contagionists that the minute organisms termed *Bacteria* are in some way connected with contagion, if not actual contagiums themselves. Dr. Sanderson defines microzymes as "living particles which, in the earliest stage of their existence, are spheroids not exceeding $\frac{1}{20000}$ of an inch in diameter, but subsequently lengthen into rods." Their existence is associated with the commencement of putrefactive decomposition of nitrogenous compounds. The question as to their origin and destiny have not hitherto been satisfactorily answered.

Microzymes, or *bacteria*, are classed by the great majority of naturalists amongst the members of the animal kingdom, and are placed next to the monads. Hallier, however, believes them to be produced by the cleavage and multiplication of nuclei in the cells

of fungi, and that they are capable of development into the higher forms from which they spring. The animal nature of these tiny objects is apparently shown by the fact that they possess locomotive powers, and that they absorb oxygen and exhale carbonic acid, like animals. Dr. Sanderson evidently considers bacteria to be members of the animal kingdom; but there is no conclusive evidence on that point. It has been proved that they are capable of growing in liquids destitute of albuminous bodies. "Pasteur's solution" consists of sugar, tartrate of ammonium, and the ashes of yeast dissolved in distilled water; in this solution bacteria freely grow. Now, it is a well established fact that ammonia, although rich in nitrogen, possesses no nutritive properties whatever as a food for animals. Plants derive their nitrogen nearly altogether from ammonia; but the nitrogen of animals is supplied directly or indirectly by the albuminoids of plants. As well might an animal endeavour to obtain carbon from carbonic acid as to attempt to nourish itself with the nitrogen of ammonia. Kuhlman's experiments,¹ performed many years ago, conclusively prove that salts of ammonia exercise no influence on the nutrition of animals. When oxygen is utterly excluded, bacteria cease to grow; but may not this be owing to arrestation in the decay of the organic matter upon which the bacteria feed? The movements of the bacteria are one of the strongest arguments in favour of their animal nature; but it must not be overlooked that very remarkable motions are observable in objects unquestionably belonging to the vegetable kingdom. Amongst the sea weeds we find the *Oscillatorias* (filaments containing granular and fluid matter) advancing by means of a regular undulating movement through the water. When examined in water under the field of the microscope, they are frequently observed to cross from one side to the other. The spores of some cryptogamic plants exhibit motions; and in the *Antheridia* there are certain cells containing bodies, which have been termed *phytozoa*, or *spermatozoids*, which exhibit motions during a portion of their existence.

Whether bacteria are animals or plants is, after all, a matter which possesses but little interest to the pathologist. The really important point to be determined—so far as their origin is concerned—is, do the bacteria spring from or develop into higher forms of life? In examining this question, Dr. Sanderson is obliged to deal with the obscure subject of "spontaneous generation," which has puzzled so many inquirers from the earliest period of philosophic research down to the present time. He does not, indeed, discuss the question whether or not under any conditions it is possible for inanimate matter to become animate without the intervention of living things; but his experiments, so far as they go, prove conclusively that as regards "the animal liquids and tissues, and the liquids which will be used as tests for the pre-

¹ See *Comptes Rendus*, xxiv., 263.

sence of microzyme germs, no spontaneous evolution of any organic form ever takes place."

Bacteria, or microzymes, grow in liquids and moist air. In liquids they do not manifest any tendency towards a connective arrangement if they are motionless; and even when they exhibit activity, their movements are not governed by any mutual relation. On the surface of liquids, however, the bacteria after a while adhere (probably by the intervention of a gelatinous substance) to each other by their sides—somewhat in the same way that columnar epithelium is formed—and produce a "scum."

Sometimes the common bacteria, which grow on moist surfaces, form with their intervening jelly viscous masses sufficiently large to be recognizable by the unassisted eye. These masses of microzymes have been termed Zooglae by Cohn. When these masses are carefully observed, foci of growth are perceived, at which the particles are spheroidal, and are indefinitely minute. Around the foci are zones of matrix, in a state of disintegration, containing staff-shaped microzymes of larger size, which afterwards disengage themselves and exhibit their proper movements. At this juncture it is probable that the microzymes become distinguishable entities in the form of spheroids; but subsequently they multiply by division.

As to the conditions of the origin of microzymes, there is a conflict of opinion; but the great majority of observers consider that they do not spring into existence spontaneously. It is, however, shown that liquids which under the highest power of the microscope appear to be perfectly free from solid particles, yet subsequently evolve microzymes without being in contact with the air. Presumably, therefore, such liquids must contain germinal matter, unless we assume that minute living beings spontaneously come into existence in them. Dr. Sanderson believes that even when water appears to be perfectly homogeneous, it may not be so in reality, but that it may contain germinal particles so excessively minute as to elude detection when sought for by means of the most powerful microscope.

With respect to the chemical nature of bacteria, Dr. Sanderson shows that they consist chiefly of albuminoids, and that their matrix is albuminous. They take nitrogen from almost every substance in contact with them, and employ this element in the building up of their own organisms. Microzymes may be regarded as the pioneers, if not the producers, of putrefaction. The evidence produced by Dr. Sanderson proves that so long as germinal matter is excluded from liquids containing certain animal and vegetable matters, the latter resist decomposition for very long periods of time; whilst the presence of the smallest quantity of microzymal germinal matter speedily sets up fermentation or putrefaction. Dr. Sanderson does not, however, commit himself to the positive statement that microzymes are the first cause of putrefaction; indeed, he does not deny but that organic matter may putrefy under the

conjoint influence of heat and moisture solely. Some experiments recently performed by Hoppe-Seyler¹ afforded results which seemed to show that temperature has more influence in producing putrefaction and fermentation than organisms have.

It is shown by Dr. Sanderson that liquids containing organic matter which have been highly heated do not ferment, provided the air with which they are in contact had also been highly heated. The same kind of liquids when they have not been exposed to a high temperature soon contain organisms. Boiled liquids containing such substances as serum of blood, when freely exposed to ordinary air, do not evolve bacteria, but they become after a while covered with tufts of penicillium. Are we, then, to infer from these facts that the germs from which microzymes spring do not exist in ordinary air, whilst the vegetable spores from which penicillium are produced do exist abundantly in that medium? When bacteria appear to originate spontaneously in liquids containing decaying animal matters, their real source is the germinal matter contained in the liquids.

It is remarkable that whilst distilled water may be obtained free from embryo bacteria, yet that ordinary distilled water often contains so much germinal matter that even the small quantity used in rinsing a glass is sufficient to develop large numbers of bacteria in a large volume of water. This zymotic property of distilled water is acquired either by admixture with traces of other waters, or by contact with moist surfaces of bottles, &c. The relative zymotic power of waters, or, as Dr. Sanderson terms it, "the faculty of water to determine the development of organic forms in a test solution to which it is added," may be estimated by comparing the degree of opalescence produced in each of two or more specimens by Pasteur's test solution. By thoroughly drying the germinal matter of microzymes, it is rendered inactive even when the desiccation is effected at a low temperature. When water is contaminated by apparently dry surfaces, it is only when the desiccation of the germinal matter is incomplete. Disinfectants, such as, for example, chlorine, carbolic acid, and Condy's liquid, may be applied to solutions in such quantity as merely to prevent the development of bacteria without arresting the growth of penicillium. One of the most important results of Dr. Sanderson's experiments is that which proves that filtration (through animal charcoal?) does not destroy the zymotic power of water. I have often expressed the opinion that the boiling of potable water is the only certain method of destroying any germs of cholera or enteric fever which may be present in it. Animal charcoal undoubtedly possesses the power of removing from water any decaying animal and vegetable matter which the latter may contain; but the vital properties of germinal matter enable it to resist those wonderful chemical powers which work so mysteriously in the pores of charcoal.

¹ See Med. Chem. Unters, p. 565. 1871.

To the medical man the most important of Dr. Sanderson's investigations are those which are described in the latter portion of his report. Their results seem to show that the normal tissues and fluids of animals do not contain bacteria or their germs. Hallier has stated that visible *micrococci* (microzymes are termed micrococci by those who believe that zymotic particles are vegetable) occur abundantly and constantly in the blood of persons suffering from contagious disease; and, according to Béchamp, they occur in living normal tissue. Dr. Sanderson has examined the blood of patients affected with scarlatina, and found that it did not contain microzymes. He admits, nevertheless, that it is possible the germinal matter of these organisms might be in the blood of persons suffering from contagious maladies, although not discoverable by the aid of the microscope. Pus from a pyæmic abscess when placed in a test solution produced in a few days immense numbers of bacteria; whilst the ordinary products of inflammatory action (simple pus) produced no such effect in test solutions. This is a most interesting fact.

The chief points established by Dr. Sanderson are as follow :—
Firstly, that fungi are not developed from microzymes nor microzymes from fungi, the common association of the two being nothing more than accidental.

Secondly, that the spores of fungi exist abundantly in the atmosphere, from which they pass into liquids.

Thirdly, that microzymes are not found in ordinary air, but in water and on the moist surfaces of solids.

Fourthly, that animal tissues and fluids do not contain visible microzymes.

Lastly, that at least one morbid product of animals (pyæmic pus) contains the germinal matter which produces bacteria.

It has been strongly urged as an argument against the germ theory of disease that it fails to account for epidemics. Why should small-pox die out in Ireland, and then suddenly reappear and rage with great violence in many parts during the last twelve months? How is it that cholera periodically invades the west from the east? Why does an epidemic gradually increase in intensity, attain a maximum of virulence, and then gradually die out? It is difficult to answer these questions satisfactorily, because all the factors concerned in the propagation of zymotic disease are not known. The anti-contagionists contend that small-pox and similar diseases are propagated by other means than by emanations from the bodies of persons suffering from the diseases, and they believe that at particular times the condition of the atmosphere and of the constitution of the population are peculiarly favourable to the spread of these maladies.

If it be admitted that small-pox and certain other diseases are sometimes caused by matters thrown off from the sick making an entry into the bodies of healthy persons, then the phenomena of epidemics may be shown to be explicable without abandoning the

theory that small-pox (and some other diseases) are only communicable from individual to individual. We can readily understand that the low forms of life which produce epidemic and epizootic disease might, under favourable circumstances, multiply to a greater extent than usual. Under such circumstances the chances of their getting into the bodies of animals would be proportionately increased, and a local epidemic would be the result. Intercommunication between the place where the germs were first developed and other places would soon scatter them over areas more or less considerable. During the siege of Paris small-pox germs largely multiplied in that city, because, owing to privation and depressing influences of every kind, the population were rendered peculiarly susceptible to the influence of zymotic diseases. The stock of small-pox germs accumulated in Paris during the siege has since, there is little doubt, been distributed over a large part of Europe.

In some epiphytic diseases we find the analogues of epidemic and epizootic maladies. The "blights" in the cereals and other plants are caused by the ravages of minute parasitical fungi. A common disease of wheat grain is occasioned by the presence of the fungus *Uredo caries*, the seeds, or sporules of which are so minute that, according to Bauer, a single grain of wheat may contain 4,000,000 of them. The fungi which produce the diseases of plants do not originate sporadically, nor are they ever found except as parasites. For years a whole locality may be absolutely or comparatively free from them, when suddenly those pests will appear and destroy whole crops. It is the same with respect to the ravages of plants by insects: suddenly the caterpillars of moths will appear in vast numbers in localities where they had previously been very scarce. A few years ago the extensive plantations at Dunsany Castle, County of Meath, became suddenly the abode of myriads of caterpillars, which speedily stripped the barks and leaves of a large proportion of the trees. On investigating the nature of the caterpillars, it was found that they belonged to a rare species of moth, which had never been observed in the locality before, but which occasionally appear in large numbers in certain districts in England. Amongst the numerous insects which ravage our gardens and fields, it is interesting to note that in the seeds of wheat there is occasionally found an infusorial animalcule, termed *Vibrio tritici*. It is, however, very many times larger than the vibriones above referred to.

Phytologists acknowledge that they cannot account for the sudden appearance of vast numbers of epiphytical fungi and other pests of the higher members of the vegetable kingdom; but their ignorance in that respect in no way detracts from the positive knowledge which they possess relative to these fungi and insects being the actual cause of epiphytical diseases. Unsuitable soils, excessive damp, and other causes predispose certain plants to succumb to the attack of parasites, but the germs must be at hand; for there is absolutely not the slightest evidence to prove that any of these

fungi originate spontaneously. No matter how sickly a wheat plant may be, it cannot suffer from the blight unless there are fungi to prey upon it.

That which is true of what we may term epidemics amongst plants also holds good with respect to epidemics amongst animals. We do not as yet certainly know, though we may venture on hypotheses, why the germs of disease long absent from a locality may reappear, and fructify to an extraordinary degree. But our want of information on this point is not the slightest obstacle in the way of our belief in the "germ theory" of zymotic diseases. On the contrary, to abandon this theory would be simply to reject the only reasonable explanation as yet advanced as to the means by which contagion is propagated and maintained. If we give up this theory, we lay ourselves open to the charge of being believers in the doctrine of spontaneous generation.

If species of bacteria or similar objects are the contagia of certain diseases, then we can understand why it is that so many persons who are near small-pox and fever patients escape, whilst persons not in contact with the infected catch the disease. The bacteria thrown off from the bodies of the sick are not equably diffused throughout the air, as a gas or vapour would be, but, for the most part, are scattered about on the clothes and on other solid surfaces, from which they may be conveyed to great distances without making their entry into the body of any one. Ordinary bacteria are not found floating about in the air: if proper precautions are taken, an animal liquid may be exposed for months to the air and yet be found free from bacteria; whilst, on the other hand, if the liquid be allowed to come into contact with a wineglass, or a wall, or ordinary water (unless the latter had been heated to a point at which animal life is impossible), it will soon teem with bacteria. Contagion in general is conveyed by means of clothes or other solid substances, and is rarely directly propagated through the air. In the report on yellow fever, by J. C. Nott, which appears in the report of the Board of Health of the City of New York for the year 1870-71, page 388, that writer says:—

"No evidence, I think, could be more complete to establish the portability of a disease. All facts being opposed to its contagiousness, I can come to but one conclusion, viz., that the germ may be closed up in trunks or boxes, or be shut up in the baggage car of a railroad, transported from one point to another (as from Mobile to Grove Hill and Citronelle), and turned loose to propagate and do its work of destruction. The disease was equally fatal at Citronelle and Spring Hill. Contagionists will doubtless regard this as a case of communication by contagion; but from the facts that I have never seen any body communicate the disease, where luggage was not taken with the patient, and that the disease generally goes everywhere that steamboats go from our infected ports in epidemic years, I see no other conclusion than the one I have before given, viz., that the germ is carried closed up with baggage, and not generated and communicated by personal contagion."

Dr. Nott believes that the germs of yellow fever are not bred within the bodies of men ; but still men carry about these germs in their clothes, just in the same way that the nurse from a fever hospital conveys contagion from the sick to the healthy, without herself becoming affected with the disease.

Dr. Sanson, in his recently published work,¹ expresses his belief in the "germ theory" of putrefaction, and he considers the germs to be of vegetable origin. With respect to the nature of the *materies morbi* of contagious disease he says, "I have been led to enunciate the theory that the poisons of spreading diseases are extremely minute living organisms, having the characteristic predominants of vegetable growths, analogous to the minute particles of vegetable protoplasm, whose functions it is to disintegrate and convert complex organic products, owing their specific properties to the special disease, not to any botanical peculiarity, but to the characters implanted in them by the soil in which they first sprang from innocuous parents, and from which they are transmitted—this soil (except in the case of their earliest origin) being the fluids of the animal body."

In his celebrated lecture on "Dust and Disease," Dr. John Tyndall thus expresses his belief in the germ theory of contagious diseases :—

"But this is by no means all. Besides these universally admitted cases, there is a broad theory now broached and daily growing in strength and clearness—daily, indeed, gaining more and more of assent from the most successful workers and profound thinkers of the medical profession itself—the theory, namely, that contagious disease generally is of this parasitic character. If I had heard or read anything since to cause me to regret having introduced this theory to your notice more than a year ago, I should here frankly express that regret. I would renounce in your presence whatever leaning towards the germ theory my words might then have betrayed. Let me state in two sentences the grounds on which the supporters of the theory rely. From their respective viruses you may plant typhoid fever, scarlatina, or small-pox. What is the crop that arises from this husbandry? As surely as a thistle rises from a thistle-seed, as surely as the fig comes from the fig, the grape from the grape, the thorn from the thorn, so surely does the typhoid virus increase and multiply into typhoid fever, the scarlatina virus into scarlatina, the small-pox virus into small-pox. What is the conclusion that suggests itself here? It is this—that the thing which we vaguely call a virus is to all intents and purposes a *seed*; that in the whole range of chemical science you cannot point to an action which illustrates this perfect parallelism with the phenomena of life—this demonstrated power of self-multiplication and reproduction. There is, therefore, no hypothesis to account for the phenomena but that which refers them to parasitic life.

Professor Huxley, in one of his addresses to the British Association, speaking of contagion, says :—

There can be no reason, then, for doubting that, among insects, contagious and infectious diseases, of great malignity, are caused by minute organisms which are produced from pre-existing germs, or by Homogenesis ; and there

is no reason, that I know of, for believing that what happens in insects may not take place in the highest animals. Indeed, there is already strong evidence that some diseases of an extremely malignant and fatal character to which man is subject are as much the work of minute organisms as is the Pebrine. I refer for this evidence to the very striking facts adduced by Professor Lister in his various well-known publications on the antiseptic method of treatment. It seems to me impossible to rise from the perusal of those publications without a strong conviction that the lamentable mortality which so frequently dogs the footsteps of the most skilful operator, and those deadly consequences of wounds and injuries which seem to haunt the very walls of great hospitals, and are, even now, destroying more men than die of bullet or bayonet, are due to the importation of minute organisms into the wounds, and their increase and multiplication; and that the surgeon who save most lives will be he who best works out the practical consequences of the hypothesis of Redi.

Dr. Bastian has laboriously endeavoured to prove that low forms of animal life originate during the decomposition of organic matter; but a careful study of the evidence which he has published in support of his views has not convinced me that organisms originate spontaneously under the circumstances which he mentions. If Dr. Bastian subjected the organic matter operated upon by him to a sufficiently high and prolonged temperature, I believe no forms of life would appear in it if air were excluded.

Mr. A. Wolff,¹ F.R.C.S., expresses his dissatisfaction with the existing theories in relation to the intimate nature of contagious diseases. He contends that there is not a multiplicity of zymotic poisons, but that all diseases are molecular motions of varying degrees of intensity. A dissection wound is one of the best illustrations of zymotic action in its simplest form, "there being no question of a special germ or vitiated secretion; so also it is observed when particles of textures which are themselves inflamed become capable of secreting inflammation in particles with which they have contact." Dr. Wolff is of opinion that all the phenomena of the zymotic diseases are under the control of the ordinary physical laws which govern growth and decomposition. He arranges the zymotics into groups, the diseases in which are connected by points of resemblance—for example, variola, vaccine, and varicella, measles and scarlatina, and so on. A number of persons placed together under insanitary conditions, and exposed to the influence of decomposing animal matter, will not always become affected with the same zymotic; for the precise form which the disease may assume does not depend upon the presence of a specific germ, or entity, but upon a variety of causes, such as, for example, the channel through which the *materies morbi* comes in contact with the healthy subject.

Notwithstanding the very ingenious reasoning of Dr. Wolff, he has not satisfied me that the cause of cholera is to be found in the catalysis of ordinary animal matter. As truly might it be said

¹ *Zymotic Diseases; their Correlation and Causation.* London: J. and A. Churchill, 1872.

that all the parasitic maladies which affect animals are referable to the attacks of a single creature as to assert that cholera and small-pox have a common origin. When a zymotic disease is prevalent, who can doubt but that it is produced by a special and not by a general cause? Simple decomposing animal matter may produce some form of disease, but could it, under any circumstances, develop syphilis, or small-pox, or rabies?

There is no doubt as to the epidemic nature of typhoid fever, and its contagious character is unquestionable; but the cases where it is directly through air or touch communicated from the sick to the healthy are rare. Perhaps this zymotic is one which does not admit of being extirpated by human agency. When our knowledge of the etiology of zymotic diseases is more perfect than it is, we shall probably distribute these maladies into two groups—namely, one to include all diseases which are only directly or indirectly communicated from individual to individual—syphilis and small-pox, for example; another in which to place those diseases which, though contagious, are sporadic under certain conditions of soil, climate, vegetation, &c. Miasmatic fevers, enteric fever, and cholera morbus are diseases which, possibly, originate from time to time spontaneously.

I have often entertained a doubt as to the zymotic nature of diarrhœa, or at least as to the propriety of placing it in the same category of diseases which include small-pox, typhoid, and scarlatina. It is not probable that the poison of this malady is a specific entity like the virus of measles or cholera. As bronchitis prevails in very cold weather, for an obvious reason, so diarrhœa prevails in summer, when fruit is abundant. Dr. J. Wyatt Crane, of Leicester, contends¹ that diarrhœa is not a true zymotic, and is not, therefore, in the ordinary sense of the word, a preventable disease. Of course, so far as private hygiene is concerned, there are many means of lessening the amount of diarrhœa; for example, by paying attention to diet, so as to avoid using foods which are likely to produce diarrhœa. Public hygiene may also do something in the direction of lessening the amount of diarrhœa, by preventing the sale of unsound food, and taking care that the milk which is so largely used by children is supplied to them in a pure condition. Still, I think that some distinction should be made between diarrhœa and the undoubtedly contagious diseases.

¹ Report of the Sanitary Condition of Leicester for 1869, by J. Wyatt Crane, M.D., Medical Officer of Health. Leicester; J. and T. Spencer. 1870.

CHAPTER XV.

VACCINATION AND RE-VACCINATION.

Small-pox has been termed the type of zymotic diseases. It is one of the most fatal, and is certainly the most loathsome of the contagious maladies. Since its first recognised appearance amongst mankind, its victims have numbered many millions. No mention of it is made in the writings of the Greeks or Romans; and the first account which we have of this frightful disease is that given by an Arabian medical writer of the tenth century, named Rhazes. Small-pox, however, was probably known in Europe about the eighth century, and there is reason to believe that it was known in England towards the latter part of the ninth century. One result of the Crusades was to spread the contagium of this disease over the greater part of Europe. Early in the sixteenth century it was imported by the Spaniards into the New World; and, according to Robertson, so dreadful were its ravages in Mexico, that in a short time three and a-half millions of the inhabitants of that country were carried off. The isolated position of Iceland long secured for that remote island immunity from small-pox; but when, in 1707, the disease did effect an entrance, it speedily destroyed one-fourth of the inhabitants. Some years later it reached Greenland, which, subsequently, it all but depopulated.

The United Kingdom has suffered severely from small-pox. In 1838 no fewer than 16,268 persons succumbed to this disease in England alone; and although, owing to vaccination and to a general improvement in the hygienic condition of the country, the mortality from small-pox is greatly lessened, it still annually carries off a large number of victims. Occasionally, too, it becomes epidemic, as in 1871-2, and slays many thousands.

In the year 1796 an English physician, Dr. Jenner, proved the great fact by which he has immortalized his name and earned for himself the lasting gratitude of man—namely, that by inducing in the human subject an attack of the mild disease termed cow-pock, immunity might be secured against the far more deadly malady, small-pox. The practice of vaccination thus introduced by Jenner has since been adopted, more or less generally, by all civilized and some semi-civilized peoples, and it has superseded the older, but inefficacious, plan of lessening small-pox mortality—namely, inoculation.

In Ireland the deaths from small-pox have steadily declined since the practice of vaccination has become general amongst all classes, and especially since the passing of the statutes rendering inoculation illegal and vaccination compulsory. During the decade ended in the year 1841, the deaths from small-pox numbered,

in Ireland, 58,006 persons, whilst an immense number of persons must have been blinded and seriously disfigured. During the next ten years the deaths numbered 38,275, from which time the disease became less prevalent, until, in 1870, it seemed to be utterly extinct in Ireland. In 1871 it became epidemic in France, England, and other places, and broke out with great virulence in Ireland, and, during two years, destroyed several thousand lives. It has now almost disappeared from the country, and, no doubt, the last outbreak was due to the importation of abundance of small-pox contagion from England and Scotland.

It is generally supposed, before the late outbreak, that the disappearance of small-pox from Ireland was due to the admirable manner in which the dispensary physicians have carried out the instructions under the Vaccination Acts, and also to the readiness which the whole population exhibited in consenting to have their children vaccinated. In the year 1870 it was a general belief that small-pox would not again appear in Ireland; that it had been eradicated, and that even if a fresh supply of small-pox poison were introduced into the country, the disease would not spread, so well protected was the population by vaccination. The small-pox epidemic of 1870-71 gave a rude shock to the belief of many persons in the prophylactic virtues of vaccination, and even led a few persons to deny that the operation was at all serviceable. In England the latter belief was far more generally entertained, and even a few physicians were to be found amongst the anti-vaccinators.

It might reasonably have been expected that our knowledge of the etiology of small-pox and of the advantages of prophylaxis in connexion with it would have been greatly increased during the recent epidemic. This expectation has not been fully realized. The published statistics showing the mortality amongst vaccinated as against unvaccinated patients are by no means so abundant as we could have hoped for. This disappointment in the result of the general negligence of the great body of practitioners is not stating in their certificates of death from small-pox whether the deceased had or had not been vaccinated; and if the former was the case, whether or not the vaccine scars were imperfect. The only statistics relative to this point are those furnished by the hospital authorities. From these it appears that a large *majority* of small-pox patients admitted into hospital had been vaccinated. In order to draw a correct conclusion from this fact, we should know the relative numbers of the vaccinated and unvaccinated amongst the population. There are no reliable statistics in reference to this point. Probably 10 per cent. of the people of England are unvaccinated; and if this estimate be admitted, it must be conceded that the protective influence of vaccination (as at present practised) is by no means so great as we have long been led to believe. This fact should be met fairly and fully by sanitarians, and, if possible, clearly accounted for. If we believe in the protective influence of

vaccination, there is indeed but one way to explain the anomaly of so large a proportion of small-pox cases being post-vaccinal—namely, that vaccination is frequently not properly performed.

The authorities of the small-pox hospitals, who so candidly admit that even so many as 87 per cent. of their patients had been vaccinated, yet show that the mortality from the disease is only from 5 to 9 per 100 amongst the vaccinated; whilst it rises to 49 per cent. amongst the unvaccinated. We further learn from this source that the mortality amongst the vaccinated who exhibit marks of perfect vaccination is so low as from 0·5 to 2 per cent. It would appear, then, that the reason why vaccination fails so frequently as a preventive of small-pox is simply because the operation is generally so imperfectly performed. It is therefore a matter of great importance that vaccinators should pay the strictest attention to the performance of this operation, and to neglect no precaution likely to ensure its success. The medical authorities in England appear to believe that there is great carelessness in vaccination, for they have issued the following code of instructions to the medical men who perform the operation by contract:—

INSTRUCTIONS FOR VACCINATORS UNDER CONTRACT.

1. Except so far as any immediate danger of small-pox may require, vaccinate only subjects who are in good health. As regards infants, ascertain that there is not any febrile state, nor any irritation of the bowels, nor any unhealthy state of skin; especially no chafing or eczema behind the ears, or in the groin, or elsewhere in folds of skin. Do not, except of necessity, vaccinate in cases where there has been recent exposure to the infection of measles or scarlatina, nor where erysipelas is prevailing in or about the place of residence.

2. In all ordinary cases of primary vaccination, if you vaccinate by separate punctures, make such punctures as will produce at least four separate good-sized vesicles, not less than half an inch from one another; or, if you vaccinate otherwise than by separate punctures, take care to produce local effects equal to these just mentioned.

3. Direct care to be taken for keeping the vesicles uninjured during their progress, and for avoiding afterwards the premature removal of the crusts.

4. Enter all cases in your register on the day when you vaccinate them, and with all particulars required in the register up to column nine inclusive. Enter the results on the day of inspection. Never enter any results which have not been inspected by yourself or your legally qualified deputy. In cases of primary vaccination, register as “successful” only those cases in which the normal vaccine vesicle has been produced; in cases of re-vaccination, register as “successful” only those cases in which either vesicles, normal or modified, or papules surrounded by areolæ have resulted. When the vaccination of an unsuccessful case is repeated, it should be entered as a fresh case in the register.

5. Endeavour to maintain in your district such a succession of cases as will enable you uniformly to vaccinate with liquid lymph directly from arm to arm; and do not, under ordinary circumstances, adopt any other method of vaccinating. To provide against emergencies, always have in reserve some stored lymph—either dry, as on thickly-charged ivory points, constantly well protected from damp; or liquid, according to the method of Dr. Husband, of Edinburgh, in fine, short, uniformly capillary (not bulbed) tubes, hermetically sealed at both extremities. Lymph, successfully preserved by either of these methods, may be used without definite restriction as to time; but with all stored lymph caution is necessary, lest in time it have become inert,

or otherwise unfit for use. If, in order to vaccinate with recent liquid lymph, you convey it from case to case otherwise than in hermetically sealed capillary tubes, do not ever let more than eight hours intervene before it is used.

6. Consider yourself strictly responsible for the quality of whatever lymph you use or furnish for vaccination. Never either use or furnish lymph which has in it any, even the slightest, admixture of blood. In storing lymph, be careful to keep separate the charges obtained from different subjects and to affix to each set of charges the name, or the number in your register, of the subject from whom the lymph was derived. Keep such note of all supplies of lymph which you use or furnish as will always enable you, in any case of complaint, to identify the origin of the lymph.

7. Never take lymph from cases of re-vaccination. Take lymph only from subjects who are in good health, and, as far as you can ascertain, of healthy parentage; preferring children whose families are known to you, and who have elder brothers or sisters of undoubted healthiness. Always carefully examine the subject as to any existing skin disease, and especially as to any signs of hereditary syphilis. Take lymph only from well characterized, uninjured vesicles. Take it (as may be done in all regular cases on the day-week after vaccination) at the stage when the vesicles are full formed and plump, but when there is no perceptible commencement of areolæ. Open the vesicles with scrupulous care, to avoid drawing blood. Take no lymph which, as it issues from the vesicle, is not perfectly clear and transparent, or is at all thin and watery. From such a vesicle as vaccination by puncture commonly produces, do not, under ordinary circumstances, take more lymph than will suffice for the immediate vaccination of five subjects, or for the charging of seven ivory points, or for the filling of three capillary tubes; and from larger or smaller vesicles take only in like proportion to their size. Never squeeze or drain any vesicle. Be careful never to transfer blood from the subject you vaccinate to the subject from whom you take lymph.

8. Scrupulously observe in your inspections every sign which tests the efficiency and purity of your lymph. Note any case wherein the vaccine vesicle is unduly hastened or otherwise irregular in its development, or wherein any undue local irritation arises; and if similar results ensue in other cases vaccinated with the same lymph, desist at once from employing it. Consider that your lymph ought to be changed if your cases at the usual time of inspection on the day-week after vaccination have not, as a rule, their vesicles entirely free from areolæ.

9. Keep in good condition the lancets or other instruments which you use for vaccinating, and do not use them for other surgical operations. When you vaccinate, have water and a napkin at your side, with which invariably to cleanse your instrument after one operation before proceeding to another.

In Ireland we have always plumed ourselves on our excellent system of vaccination; but according to the Report of the Philadelphia Board of Health for 1872, the Germans exceed us in the efficacy of their system of vaccination.

The deaths among the post-vaccinal cases of the United States have been 18·85 per cent.; Germany, 13·28 per cent.; Ireland, 27·34 per cent. The deaths last year compared as follows:—United States, 16·62 per cent.; Germany, 10·4 per cent.; Ireland, 24 per cent. These figures all show a very marked difference in favour of the vaccinations performed in Germany. The difference is even greater than can be accounted for by the other fact which we have already shown, namely, that natural small-pox is least fatal among the Germans. We must, therefore, conclude that vaccination, as performed in Germany, possesses greater efficacy than as performed in either of the other countries. The question then arises—what is the cause of this difference? This question leads us to consider the modes of practising vaccination in Germany. We are informed that the practice there is to use eighth-day lymph, and, as far as possible, arm-to-arm vaccination is prac-

tised. Eighth-day lymph, taken directly from the arm, we are prepared to say, is far superior to the crust, if not bovine virus itself. The minimum number of failures will follow the use of this lymph. It will succeed where the crust has failed, and, as we believe, will never give rise to spurious results, providing the precaution is observed to select nothing but the clear lymph from a vesicle that has not passed beyond its eighth day of development.

There is another peculiarity about the German mode of practising vaccination, namely, ingrafting upon the arm numerous vesicles. It appears to be the practice in Germany to make at least six insertions—three on each arm. We not unfrequently find, by examining the arms of German patients, that even a larger number have been made. One patient exhibited seventeen (17) distinct cicatrices; another, five square inches of vaccine scars. It has been stated by high authority, and statistics even are not wanting to show, that the efficiency of vaccination is in proportion to the number of insertions. If this is true, there is, then, no reason why German subjects should not enjoy the highest degree of protection.

These two—the use of fresh eighth-day lymph and the ingrafting upon the arm numerous vesicles—are the peculiarities which characterize the German mode of practising vaccination. The German subjects, therefore, must owe their better protection to one or the other of these, or both combined.

We desire, however, in this connection to add, that we do not believe the efficiency of vaccination is so materially increased by numerous insertions as has been supposed. We have some statistics to present hereafter, which, in a measure, will sustain this opinion. We believe that the Germans owe their better protection more to the quality of the virus which they use than to the numerous insertions which they make. A vaccine vesicle resulting from the use of fresh eighth-day lymph must needs be of genuine quality. It will be followed by a typical cicatrix, and, therefore, as our statistics show, the greatest protection possible has been conferred.

By returning to the table we find that the deaths among the patients presenting good cicatrices compare as follows:—United States, 10·24 per cent.; Germany, 7·2 per cent.; Ireland, 15·55 per cent. Last year they compared as follows:—United States, 7·55 per cent.; Germany, 11·7 per cent.; Ireland, 13·33 per cent.

The deaths among those presenting fair cicatrices compare as follows:—United States, 12 per cent.; Germany, 8 per cent.; Ireland, 40 per cent. Last year as follows:—United States, 18·6 per cent.; Germany, 11·32 per cent.; Ireland, 20 per cent.

The deaths among those presenting poor cicatrices compare as follows:—United States, 32·67 per cent.; Germany, 25·92 per cent.; Ireland, 45·83 per cent. Last year as follows:—United States, 24·85; Germany, 8·1 per cent.; Ireland, 37·5 per cent.

Dr. Malady Burke, Medical Registrar, said very sagely when examined before a Parliamentary committee on vaccination, that no safe conclusion could be arrived at relative to the protective influence of vaccination in Ireland until it was tested by the occurrence of an epidemic. The epidemic came shortly afterwards, and in Dublin alone ten thousand cases of small-pox (out of a population of 314,666 persons) had occurred in a year, and more than a thousand persons fell victims to the disease. At first the cases of small-pox were confined to the poorest and most crowded localities; but soon it had invaded the most fashionable quarters of the city, and attacked persons amongst the highest as well as the lowest ranks of society. I collected in 1872 a few statistics relative to that outbreak and published them in

the *Dublin Journal of Medical Science*. I reproduce some of them here, as well as statistics of small-pox obtained in other places.

The city of Dublin is divided into two poor-law unions, each of which includes a few suburban districts. Dr. Burnside, one of the physicians to the South Dublin Union Small-pox Hospital, informed me that from November the 15th, 1871, at which time the epidemic was beginning to assume large proportions, until the 11th April, 742 cases of small-pox were admitted into that hospital. Of these, 152 died—nearly 17 per cent. of the cases of admission. About 80 per cent. of the total cases were “modified,” and 20 per cent. confluent, at least on the face. Of purpuric cases, the per centage was between 5 and 6, and although in a few of these cases there was recovery, the great majority rapidly terminated fatally. Out of the 742 cases, 596 were vaccinated in some way, and of the latter 64 terminated fatally. “Of re-vaccinated cases,” says Dr. Burnside, “I cannot say I saw the disease occur in one when I could positively state that re-vaccination had been thoroughly performed prior to infection.” Dr. Burnside states that he has seen mild cases of small-pox amongst the unvaccinated, but they were exceptional; the mortality amongst the 146 unvaccinated cases amounted to 88 per cent.

Dr. Joseph E. Kenny, Visiting Physician to the Small-pox Hospital (Sheds) established by the North Dublin Union, furnished me with the following statistics:—

Total number admitted into North Union Small-pox Sheds from 28th October, 1871, to 20th April, 1872, 544.

Vaccinated	...	...	...	442
Unvaccinated	{ certainly	...	71	102
	{ probably	...	31	
Total	...	..	...	544

Died 113, or 20·77 per cent.

Number of deaths in unvaccinated and doubtful classes, 70 or 68·62 per cent.

Number of deaths in vaccinated class, 43, or 9·72 per cent.

The total is thus divided as to sexes:—

Males	...	...	...	313
Females	..	...	...	231
Total	...	...	...	544

Died, males, 46, or 24·2 per cent.

„ females, 37, or 16·08 per cent.

There was a greater number over than under 14 years of age. The proportion of purpuric cases was very large, and in all such cases, when well marked, the result was fatal.

With regard to those cases which are marked as doubtful as to vaccination, Dr. Kenny says:—“I mean by that to express that I could not discover any marks, and the history given by patients or friends was too uncertain to be reliable. The weight of evidence in those cases is, in my opinion, in favour of their not having been vaccinated. In four cases the attack of small-pox was the second experienced by the patients. In no case have I seen a third attack.

The intervals in the above four cases varied from 12 to 65 years. In only two cases has re-vaccination been performed, or, what amounts to the same thing, primary vaccination done within a period of three or four years. In both these cases the disease was in its very mildest form. I have seen seven cases where re-vaccination was performed within ten days of the attack of small-pox, but after, in each case, full exposure for several days to not only the infection, but also contagion of small-pox. In two of these cases the disease was very severe, and in one it proved fatal. My experience of vaccination as a prophylactic against, or a modifier of, an impending attack of small-pox does not coincide with that of Dr. Furley, as published by him some time ago. The cases I quote above, and about eight others in which I vaccinated the patients myself, do not support his theory on the subject, viz., that vaccination, if done either in the incubating stage of an attack, or even when the papules have appeared, tends to cut short or otherwise favourably modify the type of the disease. I do not think, as far as my experience goes on the matter, that this most desirable result is produced by his operation. I had tried it last November, several months before he had made public his observations. The subject, however, is, I think, worthy of further investigation. I cannot too strongly express myself in favour of re-vaccination, which I believe should be at least a decennial operation."

Dr. William Moore, King's Professor of Medicine in the University of Dublin, informed me that he had 37 cases of small-pox under his care at Sir Patrick Dun's Hospital. Of these one (a middle-aged woman) was re-vaccinated, 31 were vaccinated, 2 had previous attacks of small-pox and had also been vaccinated, and 3 were non-vaccinated. The re-vaccinated patient died from confluent small-pox; one of the patients (a woman aged 44), who had previously suffered from small-pox, recovered after a mild illness; the other case, that of a man aged 20, was severe, being semi-confluent and purpuric. Of the 3 unvaccinated cases, 1 (a child aged 5 years), died, another had a severe attack, and the third (a child aged 3 years) appears to have a mild attack, as it remained in hospital only 5 days. Of the 31 vaccinated cases, 1 (a woman aged 38) was confluent and purpuric, and terminated fatally; the remaining 29 were modified, and for the greater part mild.

We learn from Dr. Moore's cases, although they are not numerous, that small-pox is rendered less fatal by vaccination, for, including the re-vaccinated cases, only 2 deaths occurred out of 31; whilst out of 3 non-vaccinated cases, 1 died. It is remarkable that the only case of small-pox after re-vaccination admitted should have proved fatal; but it appears that this woman had been attending her husband, who was ill with small-pox, and had been re-vaccinated whilst exposed to variolous infection. When admitted she had vaccinia and small-pox at the same time, and it is more than probable that the virus of the latter disease had entered her blood before she had been vaccinated. It is also rather remarkable that

amongst 37 cases of small-pox there should be two patients who had previously suffered from the disease. We need not, therefore, be surprised to find cases of small-pox occurring amongst those who have been thoroughly re-vaccinated; for surely an attack of variola ought to afford greater protection from a second one than vaccination could reasonably be expected to confer.

Dr. Moore says in the statement which he has kindly given to me—"I may take this opportunity of mentioning that I believe in the antiseptic properties of the sulphides, and especially of sulphurous acid, which I have given in almost every case, both public and private, I have been called on to treat. In addition, where one case has occurred in a family I have given it to the other healthy members as a "prophylactic," which, coupled with other due quarantine precautions (I believe), has tended to prevent the spread of the disease."

Dr. Grimshaw, one of the physicians of Cork-street Fever Hospitals, furnished me with the following statistics relative to the admission of small-pox patients into that institution. From the 1st April, 1871, until 31st March, 1872, the admissions amounted to 425. Of these the vaccinated patients were 334, of whom 35 died; and the non-vaccinated cases number 91, no fewer than 70 of which terminated fatally. No case of small-pox after undoubted re-vaccination was admitted. These statistics having been made out in the latter part of April may be regarded as a full account of the termination of the cases admitted during March.

Dr. Lyons, one of the physicians of the Hardwicke Fever Hospital, read a paper on the statistics of small-pox, at a meeting of the Medical Society of the King's and Queen's College of Physicians in Ireland, held on the 17th April, 1872. From this paper I select the following statistics relative to admissions into the Hardwicke Fever Hospital, Dublin :—

Total number of admissions—	1,296	{ 660 Males. { 636 Females.
1841-1871		
Result—Recovered	1,011	1,296—21·99 per cent.
Died	285	

Vaccinated	322	1,296.
Not vaccinated	259	
Unspecified	715	

AGES.

Under 5 years,	152
Over 5 and under 15	396
„ 15 „ 20	288
„ 20 „ 40	442
„ 40 „ 60	17
„ 60 „ 80	1
80 and upwards	0

Gross total ... 1,296

The following figures will show the distribution of the mortality :—

	Died.	Per Cent.
Of the re-vaccinated (3 in all)	0	
Of the 542 vaccinated ...	60, all confluent, of whom 20 were also purpuric 4, not confluent, of whom 3 were also purpuric	11·20
Of the doubtful vaccinated (4 in all)	2	
Of the 66 non-vaccinated	44, confluent 10, not confluent	80·
	<hr/> 120	

The mean mortality was 11·82 per cent. of those vaccinated. Of the non-vaccinated, including the doubtful cases, the mortality was as high as 78·57 per cent., which is the most powerful argument that can possibly be adduced in favour of the salutary influence of vaccination. Our mortality in this respect differs from the recorded mortality in other epidemics. Thus, on the total admissions into the London Small-pox Hospital for ten years the average mortality was 21·44 per cent.; of vaccinated with cicatrices the mortality was only 7 per cent.; and of the total unvaccinated the mortality was only 36 per cent.

The following summary shows the admissions, deaths, and percentage of mortality at the quinquennial periods of life :—

	Admitted.	Deaths.	Per-centage mortality.	Mean.
Fœtus in utero, mothers admitted pregnant,	6	1	16·66	15·32
Under 1 year,	5	1 ¹	20·0	
1 to 5 years,	13	6	46·15	
5 to 10 „	50	7	14·0	
10 — 15 „	110	17	15·45	24·77
15 — 20 „	201	27	13·43	
20 — 25 „	119	27	23·52	
25 — 30 „	55	15	27·27	
30 — 35 „	21	9	42·85	53·33
35 — 40 „	23	3	13·04	
40 — 45 „	5	2	40·00	
45 — 50 „	4	3	75·00	
50 — 55 „	2	2	100·00	
55 — 60 „	—	—	—	
60 — 70 „	4	1	25·00	
	<hr/> 612	<hr/> 120		

Careful inspection of the above figures will show that so far this has been a *young* epidemic, or rather an epidemic amongst the young, swooping upon and cutting down the very flower of the population.

Thus, of the 612 cases recorded 379 were of and under 20 years of age, of whom 58 died, or in the proportion of 15·30 per cent.; 218 were between 20

¹ 4 months old.

and 40, of whom 54 died, or 24·77 per cent.; 15 only were of ages between 40 and 70, of whom 8 died, or in the proportion of 53·33 per cent. Of the 120 deaths, 112 were of persons at and under 40 years of age, of whom a fraction over half were at and under 20 years of age.

Taken year by year, the figures representing admissions and deaths are, in many instances, too small to admit of any legitimate conclusions being drawn from them; but the results are so singular at some of the early periods of life, that at the risk of appearing prolix I give the returns of age year by year. They may serve as a means of comparison or illustration for other statistical records, by other gentlemen connected with this Association, from whom we have reason to expect very important contributions to the history of the present epidemic.

Though imposing on others the same cautions I do upon myself with regard to these figures, I may yet be permitted to point to the comparatively lighter mortality amongst children under 1 year to the very heavy mortality of 50 per cent. amongst those at 5 years of age; to the comparatively small mortality at 10 years, only 9·52 per cent.; to the very heavy mortality at 19, 20, 21, and 22 years; to the still weightier fatality at 25, viz., 37·50 per cent., and at 26, 33·33, and to the severe incidence of the epidemic as a fatal malady at the ages between 31 and 40 inclusive, namely 27·27 per cent.

The epidemic has not been with us as young an epidemic as it has been at former periods and in other places. Thus, in the London epidemic, of 9,762 individuals who died of small-pox in 1837-38, 7,340 were under 5 years of age—a far larger proportion than our hospital returns show; 1,668 were between 5 and 15; 528 were between 15 and 30; 210 were between 30 and 70; 16 were upwards of 70. Of 2,285 deaths in London from small-pox in 1840-41, 2,060 were under 15 years of age, showing a very remarkable mortality in that institution at those very early ages, and far greater than the mortality of similar ages in this epidemic, so far as can be judged of by the records of one hospital.

Of 541 vaccinated patients admitted into the Hardwicke Hospital, only 61, or 11·44 per cent., died; in 3 re-vaccinated cases there was no death; and of 66 non-vaccinated, and 4 doubtfully vaccinated, cases, 53, or 76·19 per cent., terminated fatally.

Dr. A. O. Speedy, one of the medical officers of a large dispensary district in one of the poorest localities of the city, treated nearly 400 small-pox patients at their own homes. Not one of these had been re-vaccinated. Dr. Thomas Purcell, another of the poor-law medical officers, who treated several hundred cases of small-pox, did not meet with a single case of re-vaccination.

The statistics of small-pox and vaccination relative to the present epidemic of small-pox which I have collected plainly show that vaccination is unquestionably a protection against small-pox. It is idle to assert that persons thoroughly vaccinated enjoy perfect immunity from this disease: all that can fairly be claimed for vaccination is that it greatly lessens that "receptivity" which appears to be a factor in contracting the disease.

The experience of the public schools in the city of New York the past year has shown that in the midst of an unusually severe and widespread prevalence of small-pox, and which attacked upwards of 2,000 persons in more than 1,400 houses, the 240,000 school-children of the city have remained so secure from the contagion that scarcely a death, and only a very few cases of the disease, have occurred. Not a case, indeed, has been ascertained in which a child, with approved vaccination, has died of the disease out of this

vast number of pupils. But in a single ragged school, containing 150 pupils, only 50 of which were found to bear any mark of vaccination at the first inspection, more cases of small-pox occurred in a single fortnight after the first case than have occurred in all the well-vaccinated school-children in the city in a year. — *Bulletin of the New York Academy of Medicine*, 1870.

In his annual report on the health of Liverpool for the year 1871, Dr. Trench traces the recent epidemic of small-pox in that city to the arrival of a ship from Galicia. Two Spanish sailors had sickened at sea with small-pox in this ship, and on her arrival at Liverpool they were sent to hospital. From these patients the contagion appears to have been propagated throughout the city; but the supply of contagion was kept up by fresh arrivals of infected ships. At first 30 per cent. of the cases of small-pox were amongst seamen. The influence of vaccination as a prophylactic was clearly shown in Liverpool. Amongst the cases of small-pox where there was doubtful vaccination the mortality was 56.4 per cent.; where the patients had one visible cicatrix the deaths amounted to 14.9 per cent.; where two cicatrices were visible the mortality was 9.8 per cent.; and lastly, in the case of those who had three cicatrices, the deaths were at the rate of 7 per cent.

The *Lancet* for March 30th, 1872, contains a report by Dr. J. Harris Ross on the recent epidemic of small-pox in Brighton. 271 cases were treated in the Workhouse Hospital, and careful notes were taken of 258 of them; of these 105 were unvaccinated and 153 were vaccinated. The mortality was 28.9 per cent. amongst the unvaccinated, and 1.99 amongst the vaccinated patients. 146 unvaccinated patients were treated at their homes, and of these 38.3 per cent. died. Of 247 post-vaccinal cases treated at private houses, 32 (12.9 per cent.) proved fatal.

It would appear that re-vaccinated persons are less liable to contract small-pox than persons of the same age who are only protected by primary vaccination. This to a great extent may be due to the second operation being more carefully performed; for it is generally conceded that some years ago vaccination was often very imperfectly carried out. Since the early part of 1870 many thousand persons have been re-vaccinated in Dublin, and yet we rarely hear of re-vaccinated persons contracting variola, although at least 3 per cent. of the whole population has suffered from this disease. There are several thousand soldiers stationed in Dublin, and there has been only a few cases of small-pox amongst them, although they are of an age which is favourable to the reception of the disease. No doubt, the exemption of these soldiers from the epidemic is to a great extent due to the fact that they are, with few exceptions, re-vaccinated.

During the epidemic in London, 6,221 patients were treated in the Hampstead Hospital. Dr. Grieve gives us some interesting statistics relative to these cases. Of these, 1,248 were without marks of vaccination, and amongst them the mortality was 51.12 per cent. The deaths amongst the 4,973 vaccinated patients

amounted to 567, or at the rate of 11·4 per cent. The percentage of deaths amongst both the vaccinated and unvaccinated, taken together, was 19·36, a higher ratio than has been observed during recent epidemics.

The mortality amongst the patients who had but one vaccine scar was 17·39 per cent.; amongst those the deaths were 12·17 per cent. Of the patients showing three scars, 10·15 per cent. succumbed; and the deaths were only 8·38 per cent. amongst those who had four marks. Lastly, the mortality sank so low as 6·43 in the case of those who exhibited five or more cicatrices. Dr. Grieve concludes from these statistics that to obtain even a fair average amount of protection it is necessary to cut in three places, and that it is advantageous even to exceed that number. The patients observed in relation to the number of marks amounted to 3,555.

Out of 6,221 cases of small-pox there were only three in which there was any satisfactory evidence of re-vaccination. The nurses and servants in the hospital were re-vaccinated, and none of them contracted small-pox, though much exposed to its contagion. Dr. Grieve believes that re-vaccination is a sure protection against small-pox, but to be efficacious it must be performed after the age of fifteen years. Cases of variola subsequent to re-vaccination are merely the exceptions that prove the rule; they are more uncommon than second small-pox, and differ also in this way, that whereas the latter are frequently severe and sometimes fatal, the former are very mild indeed.

The greatest mortality occurred amongst those persons whose occupations conduced most to intemperance, or which exposed them continuously to a high temperature.

According to Dr. Guttstädt¹ vaccination is much neglected in Berlin, and during the epidemic of small-pox in 1871-72, 6,478 perished from the disease. He estimates that 14 per cent. of the unvaccinated inhabitants contracted small-pox, whilst only 2 per cent. of those vaccinated caught the disease. The mortality was 42 per cent. amongst the unvaccinated, 16 per cent. in the case of the vaccinated, and 15 per cent. amongst the re-vaccinated. There was, however, reason to believe that re-vaccination was in many instances not successfully performed.

We learn from the *Gazetta Medica Lombardia* for February 17th, 1872, the following statistics relative to the vaccination and small-pox in Milan during the year 1871:—

The total number of vaccinations performed under the auspices of the Milan municipality ("animal" vaccine virus being employed), between January 1 and December 31, 1871, was 17,069. Of these 1,504 were vaccinations of children, of which 1,270 were successful in their results, 4 were spurious, 35 failed, and 195 were not verified. There were also 15,565 adults re-vaccinated, the

¹ Transactions of Berlin Medical Society, Dec., 1872.

results being successful in 5,039, spurious in 435, and unsuccessful in 3,814, while in 6,227 they were not verified. Among these 15,565 re-vaccinations there were only 68 cases in which variola in a mild form, or varioloid, appeared.

At a meeting of the Epidemiological Society (London), held on the 8th of March, 1871, Dr. Whitmore stated that the result of a house-to-house visitation in Marylebone showed that 5 per cent. of the children were not vaccinated and 7 per cent. were imperfectly vaccinated; and further, that the public vaccinators were chiefly responsible for the imperfect attempts. It is more than likely that in most of the cases of those vaccinated persons who die from variola the vaccine operation had not been properly performed. It is certainly incumbent upon all vaccinators, public and private, to satisfy themselves fully that their work has been successfully accomplished.

With respect to re-vaccination, I am inclined to share the opinion of those who consider that it is almost as necessary as primary vaccination. I agree with Dr. Seaton when he says:—"What a powerful means we have in the re-vaccination of adults, not merely for repairing anything which was defective in a first vaccination, but also for extinguishing the susceptibility to small-pox which may re-arise among an uncertain portion even of the well vaccinated, is now a matter of familiar observation. Marson's experience with regard to his nurses and servants has been confirmed by the experience of all the metropolitan asylums during this epidemic. Not one of their re-vaccinated inmates or *employes* has suffered; and two or three apparent exceptions have but proved the rule, for they were in persons in whom, on one ground or another, re-vaccination had *not* been done. Re-vaccination, I need scarcely say, requires that we should bring to its performance all the care and all the pains to ensure success which are given to a primary case; and this is almost tantamount to saying that it ought not to be left to be done at times of epidemics, and when people are under the influence of panics. What I have long endeavoured to urge as essential for complete protection is a thoroughly good vaccination in infancy, as the sheet-anchor, and a careful re-vaccination after puberty, so conducted as to give evidence that the lymph is absorbed, and repeated, if necessary, till that result is obtained. The re-vaccination should be done as systematically about sixteen years of age as the primary vaccination is at six weeks or two months, and with this, when successful to the extent which I have stated, people may rest content."

M. Michel Levy, in an official report¹ on small-pox for the years 1865 to 1870 inclusive, shows from statistical data the great advantages resulting from vaccination, both primary and repeated, and especially the latter.

¹ Given in extenso in *Annales d'Hygiène Publique et de Médecine Légale*. Paris, April, 1871.

That eminent sanitarian, Dr. Thomas Logan, of the Board of Health, California, in reporting on the epidemic of variola in that State, says :—

I believe that the reasons why small-pox has been so universally prevalent in our State are to be found not only in the imperfect manner in which vaccination has been performed, but, without absolutely committing myself to the doctrines of Hebra, also because of the pre-conceived harmlessness entertained respecting varicella or, at all events, because of the difficulty of diagnosticating from it by any definable marks some of the irregular varioloid affections. And in this connection I would take occasion once for all to state, lest silence might be construed into an opposite opinion, that my faith is fixed and remains unshaken in that divine boon to man, which emanating from the milkmaid of Solburg, was developed by the intelligence of the medical student of Gloucester into the only safe and certain prophylactic for the most loathsome of all diseases.

Some years ago the majority of physicians regarded re-vaccination as an unnecessary operation; but the progress of enlightenment has shown that it is almost as necessary as primary vaccination. The propriety of re-vaccination has been discussed repeatedly in the journals and by the medical societies, and the weight of medical opinion leans in favour of the operation. At the London Small-pox and Vaccination Hospital the protective value of vaccination and re-vaccination has been clearly proved during the recent epidemic. From 29th September, 1870, to 6th March, 1871, 751 cases of small-pox were admitted. Of these, 618, or 82 per cent., were vaccinated; 9 per cent. of the vaccinated died, whilst 44 per cent. of the unvaccinated perished. Those amongst the so-called vaccinated who had no characteristic marks suffered severely, 22 per cent. succumbing to the malady. The nurses in the hospital were re-vaccinated, and not a death amongst them occurred. At Homerton Small-pox Hospital no re-vaccinated persons were admitted. At Hampstead the mortality amongst the vaccinated patients amounted to 7 per cent.; whilst 38·5 per cent. of the unvaccinated patients died. Dr. Grieve states in the *Lancet* for March 8, 1871, that in 800 cases of small-pox, which came under his notice in this hospital, there was not one which occurred after provable re-vaccination. As there had been a perfect vaccination mania in London and elsewhere, it is evident that a large proportion of the inhabitants of Hampstead must have undergone that operation.

At a meeting of the Surgical Society of Ireland, held on the 31st of March and 21st of April, 1871, the subject of re-vaccination was fully discussed; the majority of the speakers expressed on the whole an unfavourable opinion relative to the repetition of vaccination; but to our mind the arguments in favour of re-vaccination urged by Dr. G. H. Kidd appeared very convincing. Dr. Kidd argued that a large proportion of those who were vaccinated in youth become liable to suffer from small-pox in after life. A proportion as high as 6 per cent. under ordinary epidemic influence as proved by the epidemic at Marseilles, recorded by

Bousquet, and that at Newark-on-Trent, recorded by Bigsby, and under circumstances of repeated exposure or concentrated epidemic influence, as high even as 12 per cent. or more. That this was due to the wearing out of the vaccine influence, Mr. Kidd argued, was proved by a comparison of the ages at which the vaccinated and unvaccinated take small-pox. The greatest number of the unvaccinated taking the disease before ten years of age, while the vaccinated do not take it until between ten and twenty-five years of age, showing that vaccination in infancy is an efficient protection up till ten years of age, and then begins to wear out. This wearing out of the vaccine influence, Dr. Kidd argued, was also shown by the gradual prolongation of the stages of incubation and development in cases of re-vaccination; and he concluded by stating his opinion that re-vaccination should in all cases be performed between the ages of 10 and 15 years, and be repeated under circumstances of peculiar exposure to small-pox; and that when no effect follows the operation, it should always be repeated. Dr. Mapother contended, on physiological grounds, that a disease induced in an infant a few months old would hardly produce effects which would last unimpaired during a lifetime.

I believe that the prophylactic virtues of vaccination gradually die out; and that the operation should be repeated immediately after puberty. It might be perhaps desirable to re-vaccinate periodically, say every 10 or 15 years.

Dr. Matthew Taylor has published¹ the results of some experiments which lead him to believe that re-vaccination or vaccination after small-pox rash has appeared is useless, if not injurious. The experience of Dr. Grieve points to a similar conclusion.

Dr. Fleischmann, in an ably written paper,² contends that small-pox and varicella are distinct diseases. He maintains that vaccination exerts no influence on the development of varicella; nor does the latter exercise any protective influence in relation to small-pox. Varicella is contagious, but no one gets small-pox from a person affected with varicella, even when inoculation with matter from the pustules of varicella is employed.

That syphilis is as we frequently hear alleged commonly communicated to children by means of vaccine lymph is a theory utterly unsupportable; but it must be admitted that there is a *possibility* of danger of this kind, *unless* the vaccinator is careful. On the 25th April, 1871, Dr. Jonathan Hutchinson read a paper on "The Communication of Syphilis by Vaccination" before a meeting of the Royal Medico-Chirurgical Society of London. The facts stated in this paper are briefly as follows:—Eleven persons, chiefly young adults out of a business establishment, were vaccinated by the lymph taken from a child of four months old, and apparently quite healthy. Every vesicle on the child's arm bled. Ten of the

¹ The *Lancet*, February 1, 1873.

² Published in the *Wiener Med. Zeitung*. No. 7. 1873.

persons operated upon took vaccinia, which went through its normal course, the scabs falling off in three weeks. In five weeks, however, the cicatrices became enlarged and indurated, and subsequently they became ulcerated, and were surrounded with a rash. On inquiry, the infant vaccinifer, who had looked so healthy, was found to have five small mucous patches near the anus, and her mother admitted that she had "snuffles" and a peculiar twang in crying. The mother was apparently healthy, but a suspicion of syphilis attached to the father, which he gave no opportunity of clearing up. The child's vaccination proceeded perfectly, and there was no trace of disease in the cicatrices. The two individuals who were first vaccinated had vaccinia, but no syphilis, and all the others had bad chancres. The cases stood thus:—

Vaccinia without syphilis,	..	...	...	2
Syphilis without vaccinia,	...	...	...	1
Vaccinia with syphilis,	...	...	...	8

11

Mr. Hutchinson's conclusions from these facts were, that a child in apparent health with latent syphilis may yet afford pure vaccine lymph, or may yield syphilitic poison only, or both vaccine lymph and syphilitic poison combined.

A committee appointed by the Medico-Chirurgical Society to investigate the cases of vaccino-syphilis described by Mr. Hutchinson reported the results of their inquiry on the 27th June. They confirmed the facts stated by Mr. Hutchinson, but they were not prepared to state whether the syphilitic poison was introduced by the medium of the lymph or the blood, or by both.

Cases such as those described by Mr. Hutchinson must be excessively rare, and it would be manifestly absurd to abandon our faith in vaccination because in two or three hundred thousand cases of it one case of vaccino-syphilis might occur. It must, nevertheless, be admitted that there is a certain, though extremely slight, chance of communicating syphilis by vaccination, and the public have a right to be protected from even the slightest risk of this kind. If the directions to vaccinators above given were carried out to the letter, we would hear no more of such cases as those detailed by Mr. Hutchinson.

The *Lancet* for May 6th, 1871, in commenting upon Mr. Hutchinson's cases, expresses some doubt as to their being really syphilis. It says:—

We are not aware that, so far, any decisive evidence has been produced that could prove the sores in question to be syphilitic. For our own part, we know of *no characters whatever* that would prove the syphilitic nature of any sore on the arm following an irritant wound, unless there were clear constitutional symptoms of syphilis. The most experienced syphilogue in the world has no right to affirm, from the mere aspect of any sore following an irritant wound, that it is syphilitic. Such sores are constantly observed, presenting the hardened base and the peculiar margin which are seen in the

indurated chancre, and cicatrizing precisely in the form of the "fungoid" eminence or "bouton" which follows the true syphilitic sore; and yet the observer knows that the primary lesion could not by any possibility have been syphilitic, and he finds that no constitutional symptoms follow it. Such was the nature, most unquestionably, of the sores produced by those unhappy vaccinations in Brittany in 1866, which caused such a terrible hubbub, and produced the disastrous debates in the Académie Médecine. And we have been independently informed by three different London practitioners, who have been largely engaged in vaccinations during the last six months, that a comparatively common phenomenon of vaccination has been the formation of an extremely ugly-looking sore, which exactly resembled a syphilitic chancre, both in the open and the healed state, but which (out of some score of cases) entirely and perfectly subsided without a vestige of evil result, through several months have now elapsed. This is only a corroboration of what we ourselves have repeatedly witnessed in former days. Now, at present, Mr. Hutchinson's cases have presented no more diagnostic phenomenon than the above, *plus* a certain amount of roseola (of itself by no means distinctive), and a doubtful amount of "headache and pains in the limbs" in two or three cases. Assuredly, something much stronger than this is needed; and we hold that the Medical and Chirurgical Society will gravely fail in its duty if it admit the syphilitic nature of these affections without a far more cogent proof.

The *Lancet* warns the Fellows of the Royal Medico-Chirurgical Society not to lightly unsettle the belief which the great majority of the people have in the efficacy of vaccination, and instances the case of Paris, where the scientific *dilettanti* frittered away the confidence of the public in vaccination by long-winded disquisitions on a supposed epidemic of vaccino-syphilis, which proved, after all, to be a "complete mare's-nest." The consequence was that vaccination was completely neglected, and small-pox has ravaged Paris in a manner that reminds one of the plagues of the middle ages.

Dr. Tilbury Fox says (*Lancet*, Nov. 1874), "I have no hesitation in announcing myself a firm believer in the occurrence of true vaccinal syphilis; I have satisfied myself, clinically, that it does occur at the same time I am quite sure that very many cases to which this designation is applied are in reality only instances of latent hereditary syphilis excited by the vaccination, and in which the vaccination cannot in any way be fairly blamed for the occurrence of the syphilis."

At a meeting of the Royal Medical and Surgical Society, held at London on the 28th January, 1873, Mr. Jonathan Hutchinson read his second report upon the communication of syphilis in the practice of vaccination. The cases which he records certainly strengthen materially the statements put forth in his first report upon this matter. The following is a brief history of the cases detailed in the report. A respectable married man, aged forty-six, applied to Moorfields Ophthalmic Hospital on account of iritis, which at once was perceived to be syphilitic. He had been vaccinated three months previously, but the sore, which healed, readily broke out a month after vaccination, and assumed the form of a hard chancre. A fortnight later an abundant secondary rash appeared, and in a month after iritis set in. This man had been vaccinated

with lymph taken from a child who showed no symptoms except "a sunken bridge of the nose." Twelve persons had been vaccinated from lymph obtained from this child, and there was reason to believe that the man in question had been the last. It is therefore probable that in his case the lymph was mixed with serum or blood. The second case recorded by Mr. Hutchinson was that of a lady, aged forty-five years. She consulted Mr. Hutchinson as a private patient, and complained of a vascular growth in the urethra. During examination the remains of a copious and dusky rash, evidently of syphilitic origin, were discovered. She stated that five months previously she had been vaccinated by four punctures, none of which proved successful. A severe rash and inflammation of an eye followed, and she felt very ill. A careful examination showed the presence of a dusky scar at the seat of one of the vaccination punctures; but it was not like a normal vaccine cicatrix, and the synechiæ observed in the left eye proved that the organ had been affected with iritis. The patient stated that a month after vaccination one of the punctures inflamed, and became a hard-edged ulcer, which lasted three months. In this case the vaccinifer was stated to be a healthy child at the time when the lymph was taken from it, but subsequently it had very unwholesome sores about the anus, for which it was under treatment for three months. Several persons had been vaccinated with lymph furnished by this child, but, with two exceptions, it was not ascertained whether or not syphilis followed the operation. In the case of the exceptions no ill results were observed.

Mr. Hutchinson considers that these cases and others prove that syphilis may be propagated by the vaccinator. He asks what are we to infer from the fact, that of twelve persons vaccinated from the lymph of a syphilitic child only one became tainted; and he states that we must either believe that the virus of syphilis is not contained in the lymph at all, or that it is not equally diffused throughout it. It would appear that we may vaccinate from a tainted vaccinifer without conveying the infectious matter of syphilis; and, on the other hand, it is possible to propagate syphilis with or without vaccinia in the operation of vaccination. Accidentally, on many occasions, lymph has been taken from tainted children and employed without any bad results. It is, therefore, highly probable that the virus of syphilis is not contained in the vaccine lymph, but that it is derived from, or at least is associated with, some cell elements of the blood, which need not necessarily be palpably red.

Mr. Hutchinson thinks that, with regard to prevention, it would be desirable to disseminate as widely as possible amongst medical men a knowledge of the fact that syphilis may be conveyed in the matter used in vaccinating. It would be proper to avoid vaccinating from children whose parents are unknown to the operator. Lymph should not be taken from first-born children, as it would be desirable to wait until the development of one healthy child

afforded *prima facie* evidence that the next one would be free from constitutional taint. Lastly, it is most important to avoid blood-stained lymph and recent exudations from the walls of the vesicle.

In the annual report for 1869, the medical officer of the Privy Council, Mr. Simon, deals in an exhaustive manner with this question, and shows that when vaccination is properly performed, it could not by possibility be the means of introducing syphilis into the system. He examines into all the alleged cases of syphilitic inoculation by means of impure vaccine lymph, and reduces them to fourteen in number, in which "the so-called vaccinator did somehow or other produce the result which was attributed to him." All these cases Mr. Simon believes to have been the result of *mala praxis*. The operator may, by some slovenly or careless act, have mixed the poison of syphilis with the vaccine matter; or he may have altogether substituted the former for the latter. "If," says Mr. Simon, "our ordinary current vaccination propagates syphilis, where is the syphilis that it propagates? Who sees it? The experience of this department is an entire blank upon the subject. For the last ten years we have been in incessant intimate communication with the different parts of England on details of public vaccination, and during these ten years every one of about 3,500 vaccination districts, into which England is divided, has been visited three or four times by an inspector, specially charged with the duty of minutely investigating the local practice of vaccination; yet from this systematic and extremely detailed search for all that has to be said on the subject of vaccination in England, no inspector has ever reported any local accusation or suspicion that a vaccinator had communicated syphilis."

Schreier of Ratisbon, Heim of Wurtemberg, Boeck of Christiana (so well known for his numerous investigations relative to the inoculability of syphilis), and Taupin of Paris have designedly vaccinated persons with lymph taken from syphilitic children, yet in no one instance did they succeed in communicating the syphilitic taint by that method. In Boeck's experiments care was taken to mingle blood with the lymph, so that it might not be said that although lymph had failed to carry the poison of syphilis, the blood of the child might have contained the contagium.

The cases described by Mr. Hutchinson are very strong proofs in favour of his statement that syphilis may be propagated by the operation of vaccination. Such cases must, however, be of the most extreme degree of rarity; nor do they prove that syphilitic poison can exist in the vaccine lymph itself. Even when a tainted child is the vaccifer, only an extraordinary combination of unfavourable conditions can cause it to be a means of communicating syphilis. In one of Mr. Hutchinson's cases twelve persons were vaccinated from the tainted child, and only one—the last—was affected with syphilis. The poison in the blood of the child must have been in a high state of activity, and a portion of it, or of its

serum, mixed with the vaccine lymph, was, no doubt, the cause of the mischief. It must, however, be a rare case where the blood of a person suffering from any form of syphilis is so highly charged with the poison of that disease that a minute particle of it is capable of conveying infection. When we consider that there are nearly three-quarters of a million of children vaccinated annually in these countries, it is evident that if cases of vaccino-syphilis were other than barely possible, we should hear of very many cases such as those described by Mr. Hutchinson.

In an official report presented to the Préfet of the Department of Tarn by the Director of Vaccination, Dr. Paul Lalagade, we find the following positive statement relative to the non-existence of vaccino-syphilis:—"Aujourd'hui comme autre fois, et plus autorisé par une plus longue expérience, j'ai l'intime conviction la plus absolue, que le vaccin humain, recueilli et inoculé avec prudence, c'est-à-dire seul, ne transmet et ne peut transmettre aucune maladie en dehors de la vaccine."

Dr. Lalagade states that during his experience, extending over a period of thirty-one years, and relating to 30,000 vaccinations and re-vaccinations, he has never known an instance in which any constitutional malady or syphilitic affection was transmitted by vaccination. At the same time, he urges the necessity of caution in the selection of vaccinifers. The child should be more than three months old, healthy, and of healthy parentage.

In his report for 1869, Mr. Simon gives the results of Dr. Seaton's inquiries relative to animal vaccination on the continent. They show that it would be most undesirable to adopt that system in these countries. It would appear that even the most careful practitioners find it difficult, and sometimes impossible, to transmit "successive vaccinations from calf to calf without very frequent recurrence of failures and interruptions." The proportion of unsuccessful attempts to vaccinate perfectly, to successful efforts, appears to be exceedingly high. At Rotterdam, for example, the proportion of unsuccess was nearly twenty times greater than in the case of arm-to-arm vaccination. With respect to the preservability of lymph, we learn that specimens of human and animal lymph were sent from Holland to one of the eastern possessions of that kingdom, undergoing in the transit considerable alterations of temperature. Of forty-four children who were vaccinated with the human lymph, sixteen exhibited all the symptoms of vaccinia; whilst in not one of forty-seven cases in which the animal lymph had been employed had successful vaccination been the result.

CHAPTER XVI.

DISINFECTANTS—DEODORANTS—ANTISEPTICS.

In the popular and most comprehensive sense, all bodies are termed disinfectants which are used for the purpose of preventing rapid decay in organic bodies, of removing foul odours, and destroying mephitic gases and vapours. Many of the most valuable of the disinfectants are really antiseptics: they act by preventing putrefaction and fermentation, although they do not altogether prevent a very gradual but innocuous decay. The disinfectants proper—such as, for example, chlorine and nitrous acid—do not preserve organic bodies from decay, but, on the contrary, if they are used in sufficient quantity, they usually utterly destroy, *i.e.*, mineralize them. There are animal and vegetable bodies which are agents intermediate between disinfectants proper and antiseptics, pure and simple: these bodies prevent decay in organic matter not yet putrefying or fermenting; whilst they destroy more or less completely the offensive products of putrefaction, such as, for example, sulphuretted hydrogen and the fœtid ammonias.

The presence of low forms of life or their germs is, if not always, at least generally, in some way associated with putrefaction. Now, most of the substances employed as disinfectants possess the power to destroy these minute organisms and their germs. It is remarkable that some substances which are deadly poisons to the highest members of the animal kingdom can actually be eaten with impunity, and apparently with advantage, by creatures of lower organization; whilst, on the other hand, bodies which exercise little, if any, toxic effect upon the higher animals are capable of destroying many kinds of those tiny animated specks which we designate animalculæ. It is evident that if the germ theory of contagious disease be true, the greater the power of disinfectants to prevent the evolution of low forms of life is, the more valuable are they as sanitary agents. Large numbers of disinfectants, deodorants, and antiseptics are at present in use, and it would be of practical importance were their relative values and special applications clearly ascertained.

Dr. John Dougall, of Glasgow, has made very elaborate series of experiments in relation to the power of certain substances to check decay, and to destroy the lowest forms of life.¹ His general method of procedure consists in adding determinate quantities of salts, acids, alkalies, and various other substances to measured

¹ Report of British Association for the Advancement of Science for 1871. Also Glasgow Medical Journal, Nov., 1872, and February, 1873.

quantities of some such organic mixture as filtered solution of beef juice or infusion of hay. The mixtures are kept at a temperature of from 58° to 68° Fahr., and examined carefully periodically. The appearance presented by each mixture after the lapse of a certain period of time is taken as showing the efficacy of the antiseptic employed. In some cases the beef juice begins to putrefy very rapidly, and large numbers of low forms of animal or vegetable life, or of both, are observed in it. On the other hand, when mixed with certain antiseptics, organic matter remains for a very long time without putrefying.

Dr. Dougall considers that the relative efficacy of the substances with which he experimented as anti-putrefactive and anti-fermentative agents is approximately shown in the following table:—

Names of Group.	Anti putrefactive Power.	Anti fermentive Power.	Total Antiseptic Power.
I. Metallic Salts, .	46·6	64·1	110·7
II. Organic Acids, .	42·1	44·6	85·7
III. Inorganic Acids, .	35·6	37·7	73·3
IV. Salts of the Alkaline Earths, . .	29·6	41·	70·6
V. Organic Salts, .	12·7	[44·4	57·1
VI. Tincture of Iodine and Alcohol, .	5·3	76·5	81·8
Totals, . . .	171·9	307·3	

The following are the more important features of Dr. Dougall's experiments. The metallic salts show the highest preventive power, but some of them stand low in the group, whilst sulphate of copper has a very high preventive power. The organic acids have, as a group, a preventive energy nearly equal to that of metallic salts; but the extremes in this group are not so great as in the case of the metallic salts. Amongst the inorganic acids, sulphuric acid occupies a very high place, and it brings up its group to a comparatively high position. Alcohol and its derivatives have higher preventive power than we had believed them to possess. Were it not for the remarkable disinfecting properties of bichromate of potassium, the preventive powers of the inorganic alkaline salts would be very low. The salts of the alkaline earths would also have a low place were it not for the chloride of aluminium, which possesses somewhat high antiseptic powers. The aromatic oils are inert in the urinous and albuminous liquids, but have a tolerable preventive power in the hay infusion. The groups

of animal substances and bitter extracts show little save blanks; and the poisonous vegetable extracts have literally no preventive power at all.

It is curious that sulphurous acid, which has so long been extolled as a powerful disinfectant, should be found by Dr. Dougall to be inferior to oil of vitriol and other bodies not usually classed amongst disinfectants. Dr. Dougall used, however, the solution of sulphurous acid gas in water prepared according to the formula given in the British Pharmacopœia. This solution contains only 10 per cent. of actual sulphurous acid; whilst I presume Dr. Dougall employed the strong sulphuric acid of the Pharmacopœia. Permanganate of potassium and Condyl's fluid—disinfectants of high reputation—possess very feeble preventive power. Bichromate of potassium gave such good proofs of its preventive power that Dr. Dougall was led to experiment with its acid constituent, chromic acid. This body he found to possess the following preventive powers:—

Hay infusion, 1·4000; urine, 1·1400; beef juice and egg albumin, 1·1200; average, 1·2200.

These results prove the remarkable disinfecting properties of chromic acid, and Dr. Dougall expresses an opinion that this compound will yet take the foremost place amongst sanitary agents. It is, however, doubtful if chromic acid can be produced at so low a cost as to enable it to compete with carbolic acid, chloride of lime, and other cheap disinfectants.

Dr. Dougall assigns a very high position to chloride of aluminium amongst the disinfectants. In the case of the hay infusion, its preventive power is double that of any of the other substances named in the tables. It has been used to disinfect the sewage of Dublin, and the foetid mud laid bare during low water on the foreshores of the River Liffey, and in each case with decided success, and at a low cost. One pound of chloralum (a commercial article containing a large proportion of chloride of aluminium, lately brought prominently under public notice by Mr. Gamgee, the eminent veterinarian) dissolved in five gallons of water was used in disinfecting 25 square yards of foetid slob. Mr. Wanklyn, the well-known London chemist, says of chloralum:—"For removing fœtor and effluvia it is better and more available than any agent with which I am acquainted. In this respect it is incomparably superior to chloride of lime."

Dr. Dougall did not use solution of chloride of lime in any of his experiments; and he does not give us the strength of the "solution of chloride of calcium" which he employed.

Dr. Dougall believes that animalcules and fungi rather prevent than cause putrefaction. They are nature's scavengers and sanitary police, sweeping away the decomposing organic matters, which, if not reorganized into the mechanisms of these tiny objects, would produce noxious vapours and gases. Animalculæ and fungi are the *signs*, but not the *cause*, of decay. If organic matter be not

present in a decomposing state, the fungi and bacteria will not appear, because there is no nutriment upon which they could subsist and multiply. Disinfectants, according to this view, would probably prove useful, not so much by destroying animalcules and fungi as by preventing rapid molecular changes in the substances with which they are mixed. Dr. Dougall's view of the functions of the lowest forms of animal life are in accord with those of Professor Owen. "Consider," says that philosopher, when speaking of the infusoria, "their incredible numbers, their insatiable voracity, and that it is the particles of decaying vegetable and animal bodies which they are appointed to devour and assimilate. Surely, we must in some degree be indebted to those ever-active invisible scavengers for the salubrity of our atmosphere. Nor is this all. They perform a still more important office, in preventing the gradual diminution of the present amount of organic matter upon the earth; for when this matter is dissolved and suspended in water in that state of comminution and decay which immediately precedes its final decomposition into the elementary gases, and its consequent return from the organic to the inorganic world, these wakeful members of nature's invisible police are everywhere ready to arrest the fugitive organized particles, and turn them back into the ascending stream of animal life. Having converted the dead and decomposing particles into their own tissues, they themselves become the food of larger infusoria, and of numerous other small animals, as the rotiferæ, which in their turn are devoured by larger animals, as fishes; and thus a pabulum fit for the nourishment of the highest organized beings is brought back by a short route from the extremity of the realms of organic matter."

Dr. Dougall considers that the results of his experiments fairly admit of the following conclusions:—

1. That putrefaction and fermentation are not identical processes, though apparently producing similar results. Putrefaction *per se* in a fluid, as distinguished from fermentation, is characterized by the presence of microzymes, putrid odour, haziness, neutral, alkaline, or faint acid reaction, and slowness of change. Fermentation in a fluid consists in the presence of torulæ, tufts of mycelia, leptothrix filaments, and other cryptogams, mouldy aroma, transparency of fluid, distinct acid reaction and rapidity of change, as compared with that produced by putrefaction. The ultimate results of both processes are, however, similar.
2. Simple solutions of organic matter, when they decompose, putrefy in the first instance.
3. Different organic solutions vary in the time of their decomposition.
4. Putrefaction is more difficult to prevent than fermentation.
5. The majority of neutral and faintly acid solutions of organic matter, when they decompose, putrefy in the first instance.
6. Neutral mixtures remain neutral after putrefying—with but one exception—pure quinine, which remains alkaline.

7. Fermentation and putrefaction may proceed for a short time together, but almost never originate simultaneously. The only exception is alcohol.

8. Fermentation very frequently subsides into putrefaction, but putrefaction is seldom intensified into fermentation. Out of 65 instances in which fermentation and putrefaction occurred in the same solution, fermentation changed into putrefaction 55 times, and putrefaction into fermentation only 10 times. In the former the change took place early, generally in from two to ten days. In the latter, late, in from 50 to 90 days. In the ten instances *torulæ* were present only, and sparse, except in the alcohol solution, in which were *penicillia* only. Hence, when fungi appear in a putrid liquid there are almost always *torulæ*.

9. When *penicillia* are found in a solution of organic matter it is almost carried away.

10. Moderately acid solutions of fresh organic matter generally first quickly ferment and soon putrefy.

11. Most fresh organic fluids, becoming putrid when rendered acid, become, with few exceptions, neutral.

12. The same acid substance in different proportions may determine putrefaction or fermentation.

13. The odours of fermentation and of putrefaction are distinct.—Organic matter in a state of fermentation has usually an earthy or mouldy odour, but not always unpleasant. The effluvia of putrefaction vary, but are always repulsive, and easily discriminated from the musty rotten straw odour of fermentation.

14.—Almost all antiputrefactives are acid.

15. The best antiputrefactives are acid.—Mercuric dichloride, chromic acid, potassic dichromate, cupric sulphate, benzoic acid, argentic nitrate, &c.

16. Good antifermentives are commonly bad antiputrefactives, and are neutral.—*Vide* baric chloride, quinine, *heberia* sulphate, iodine, alcohol.

17. A good antifermentive may be a fair antiputrefactive.—Zinc, chloride, sulphurous acid, hydrocyanic acid, quinine, iodine.

18. Bad antifermentives are commonly good antiputrefactives, and are acid.—Aluminic chloride, sulphuric, oxalic, nitro-hydrochloric, and arsenious acids, plumbic acetate, &c.

19. A good antiputrefactive may be a fair antifermentive.—Potassic dichromate, iron alum, zinc sulphate, cupric sulphate, plumbic acetate, picric acid, &c.

20. Fermentation may begin and end *per se* in an organic solution.—All mixtures figured¹ in the fungi columns and blank in the corresponding microzyme columns.

21. Putrefaction may begin and end *per se* in an organic solution.—All mixtures figured in the microzyme columns and blank in the corresponding fungi columns.

¹ This statement, and a few others, refer to the tables in Dr. Dougall's paper.

22. The best antiseptics are acids, mercuric dichloride, benzoic acid, chromic acid, cupric sulphate, argentic nitrate, potassic dichromate.

Dr. Dougall also gives us the results of experiments which he made to determine the influence of antiseptics and disinfectants on vaccine lymph. He states that his results, so far as chlorine is concerned, confirm those of my own experiments given in the appendix to this work.

In a paper¹ which I read before a meeting of the Medical Society of the King and Queen's College of Physicians, and which is published in the Dublin Journal of Medical Science for June, 1872, I have described the results of some experiments which appear to show the inutility of ordinary gaseous disinfection. I found that vaccine lymph retained its infecting power when exposed for 24 hours to an atmosphere highly charged with chlorine or sulphurous acid gas. Bacteria exposed for 24 hours to the influence of dry chlorine and sulphurous acid also retained their vitality. Disinfectants to be useful must be liberally applied.

P. C. Plugge, in a very elaborate paper² on the value of phenol (carbolic acid) as a disinfectant, inclines to the view that living organisms originate the process of fermentation and putrefaction. He considers that in any case it is important to render the organisms that are found in putrefying and fermenting substances harmless. He finds that in liquids sufficiently acidulated, only harmless moulds appear; and, therefore, he proposes to add an acid to organic liquids, so as to prevent the production of dangerous forms of animal life. Phenol, according to this author, is the most efficacious acid to employ. The butyric fermentation in milk was prevented by the addition of $\frac{1}{230}$ part of phenol, and minute quantities of it prevented the transformation of starch into sugar, and of albuminoids into peptones. The antiputrefactive influence of phenol was compared with sulphate of iron, chlorine, chloride of lime, the permanganates, and the mineral acids; and in every instance the result was in favour of the carbolic acid. Dougall's experiments with carbolic acid did not afford results so favourable to that article.

The researches of Fremey (*Les Mondes*, No. 7, 1872) led him to assert, contrary to the views of Plugge and many others, that fermentation can take place without the presence of living organisms. He considers that he has produced alcoholic, lactic, and butyric fermentation in the complete absence of germs. He claims to have demonstrated by experiments upon barley, grapes, milk, beer, yeast, and the mother liquors that ferments are not derived from germs.

¹ This paper is given in great part in the form of an appendix to this volume.

² Pflueger's Archiv. für Physiologie, v. 538.

Hygiene of the Sick Room.—The atmosphere of a room in which a patient lies cannot be subjected to the influence of such disinfectants as sulphurous acid or chlorine. Abundance of fresh air should be admitted—in fact, too much attention could hardly be paid to the ventilation of the apartment, and it should be provided with a fire-place. The larger the room is, the better for both patient and attendants. Light should, unless under very peculiar circumstances, be freely admitted. Solution of chloralum or permanganate of potassium should be placed in large saucers. The dejecta and saliva of the patient should be instantly covered with a strong solution of bluestone, chloralum, or a weak solution of chloride of lime; and they should be speedily conveyed from the room. Slops of any kind ought to be promptly removed. The less furniture (consistent with comfort) the room contains the better. Window and bed curtains, carpets, and table cloths should not be tolerated. The linen which has been removed from the patient is best placed in a tub containing chloride of lime solution. In a house where there are several inmates, it is well to hang a sheet moistened with chloralum, &c., outside the door of the sick room. Instead of handkerchiefs, the patient might use rags, and these after use should be placed in a basin, and covered with disinfecting solution. The attendants should place themselves in such a way that the air entering the apartment would pass from them towards the patient. The less communication held between the inmates of the sick room and those of the other apartments (who are obliged to remain in the house) the better. Should the patient die, the body should be isolated, and interred as speedily as decency admits of.

Disinfection of the Empty Room.—After the removal of the patient, the room should be thoroughly cleansed, disinfected, and aired. All the furniture which admits of it should be washed with strong chloralum solution and removed to an empty room. The apartment being completely denuded of its furniture, the process of purification is to be performed in the following manner:—Wash the floor and woodwork with water and (preferably carbolic acid) soap. Remove the wall paper (first washing it with solution of chloralum or other disinfecting agent, so as to protect the workmen), and wash the walls with solution of chloride of lime, or hot lime wash. Close up all openings except the door; and having generated a sufficient quantity of a powerful disinfectant, instantly retire and close the door. After twenty-four hours the door and windows are to be thrown open, and in a few days the room is ready to be re-papered, and its ceiling whitened.

The quantity of disinfectant used should be proportionate to the size of the room. If it contain 2,000 cubic feet of space, it would require the combustion of about 27 pounds of sulphur to convert all the oxygen of the air into sulphurous acid, and even then only one-fifth of the space in the room would be occupied with sulphurous acid (fumes of burning sulphur). I do not think that less

than 4 pounds of sulphur would produce sufficient fumes where-with adequately to disinfect a room containing 2,000 cubic feet. Chlorine is, in my opinion, a much more powerful disinfectant than sulphurous acid. For a room such as that above described, it would be necessary to employ the gas evolved from a mixture of $2\frac{3}{4}$ pounds of alum cake and 3 pounds of chloride of lime, or (but mixed with hypochlorous acid) of 3 pounds of bleaching powder and 1 pound of oil of vitriol, diluted (previously) with four times its volume of water.

The sulphur is best burnt in one or more earthenware pipkins, containing a few red hot coals, and placed upon flags, slates, or over water, so as to avoid accident from fire. In liberating the chlorine the greatest care must be taken, especially when oil of vitriol is employed. The oil of vitriol should be diluted in an earthenware vessel, which is capable of withstanding the heat evolved from the mixture. The bleaching powder is best placed in a crock, or large baking dish, and the diluted acid poured into the latter. As a copious disengagement of gas of a most irritating and poisonous nature takes place the instant the acid comes into contact with the powder, the operator must effect a precipitate retreat from the room, instantly closing the door after him. Whilst working a muffler should be kept over the mouth and nose. To disinfect with nitrous fumes, mix 1 pint of commercial nitric acid with an equal quantity of water, and pour the diluted acid upon $\frac{1}{2}$ a pound of copper turnings. If copper filings be used, the disengagement of the fumes takes place very rapidly. I do not recommend the use of nitrous acid unless where a medical officer of health personally superintends the disinfection. The atmosphere of a room may be disinfected by means of liquids; but in such cases the purifier must be applied in the form of spray, which cannot, in all cases, be readily accomplished.

Disinfection of Clothing.—Clothes that are not injured by being washed may be disinfected by prolonged steeping in solution of chloralum (half a pint of the commercial solution to a gallon of water) or, preferably, chloride of lime (6 ozs. to the gallon). Coloured fabrics are injured by chloride of lime, and uncoloured linen and calico articles cannot be left long in its solution without being more or less injured. If Condry's solution be used, merely thoroughly immerse the linen in it, and speedily rinse out in cold water; for if the article be left too long in this solution it is liable to become stained. Air heated to from 260 degs. to 300 degs. Fahrenheit is undoubtedly the best disinfecting agent for clothing and bedding, as it does not in the slightest degree injure the articles, whilst it is as effective as the most powerful of the ordinary disinfectants. An oven cautiously heated may be employed, the articles being kept in the heated air for a couple of hours at least. The Corporation of Dublin have constructed a hot air disinfecting chamber at a cost of £400. It is situated in Marrowbone-lane, in the "Liberties," and any poor person may have their tainted cloth-

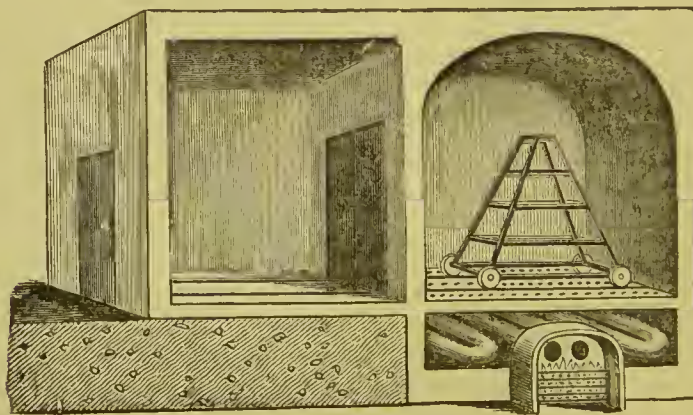
ing disinfected in it without any charge, or in the case of others, at the following nominal charges :—

Charges for disinfecting articles at the hot-air chamber.

	s.	d.
Per day of 9 hours, at disinfecting temperature (300°) ...	8	0
Per period of 5 hours, ditto ...	5	0
(These charges include coals and attendance.)		
Disinfecting single blankets, each ...	0	1
„ per pair of double ...	0	1½
„ rugs, each ...	0	1½
„ quilts, each ...	0	1
„ sheets, pair ...	0	1
„ bed ticks, each ...	0	1
„ pillow cases, pair ...	0	0½
„ great coats ...	0	2
„ body coats ...	0	1¼
„ trowsers ...	0	1
„ small articles, dozen ...	0	6
„ shawl ...	0	1½
„ hearth rug ...	0	2
„ carpets, dozen yards ...	0	3
„ curtains, pairs ...	0	2

Articles belonging to the poor are disinfected gratuitously, if ordered by medical or relieving officer.

It is to be regretted that the citizens of Dublin do not more frequently avail themselves of the great advantages which this hot air chamber offers as a means of stamping out scarlatina, whooping cough, and similar diseases. If this chamber were in constant requisition, I can hardly doubt but that the mortality from zymotic diseases in Dublin would soon be sensibly diminished.¹



Hot Air Disinfecting Chamber.

The engraving shows the construction of the chamber. The walls and ceiling of the compartment in which the clothes are

¹ Anyone requiring clothing to be disinfected at the hot air chamber should write a day previously to the articles being sent to the keeper of the chamber, Corporation Depot, Marrowbone-lane. The articles may be enclosed in sacking or matting and sent in a hand or other cart, but not in a cab or similar vehicle.

heated are built of brick, and its floor is composed of perforated iron plate. The heat is radiated into the compartment from the exterior surface of a coil of iron pipe, 80 feet long, and which acts as part of the furnace flue. The products of the combustion which takes place in the furnace escape into the atmosphere, without previously mixing with the air contained in the close chamber; no emanations from the infected clothes can pass into the atmosphere, and consequently no one need feel alarmed at the close proximity of the apparatus.

Sewage Disinfection.—Solution of chloralum, carbolic acid, or of some such metallic salt as copperas, should occasionally be poured into the sinks, and all other places leading to the sewer. The ash-pit or midden is benefited by the occasional sprinkling of a disinfecting liquid. If there be a cistern of water devoted exclusively to the W. C., pour into it daily a wineglassful of carbolic acid solution. One pound of chloralum powder, five pounds of sulphate of iron, or one pint of carbolic acid are sufficient quantities to add to five gallons of water; if the sewers be very offensive, somewhat stronger solutions may be applied; whilst for watering streets the solution may be ten times weaker. On the whole, carbolic acid seems the best application to sewage.

For manure heaps and liquid manure, chlorine and chloride of lime are very unsuitable, whilst iron per chloride and chloralum are suitable applications. If the manure be quite fresh, quick-lime is a good preservative, but this substance acts unfavourably on stale manure. One pound of freshly burnt quick-lime is sufficient for 100 gallons of fresh liquid manure, and it will preserve its fertilising qualities for a long time.

The following substances include all the really useful disinfectants and antiseptics:—

Nitrous Fumes.—On dissolving copper in nitric acid a colourless gas is evolved, which, on coming into contact with the air, absorbs oxygen from the latter, and produces ruddy fumes—a variable mixture of nitrous acid and hyponitric acid. These fumes are, perhaps, the most powerful of the gaseous disinfectants, but they are so dangerous to life that they should only be used under the immediate superintendence of a scientific or medical man.

Chlorine.—By heating black oxide of manganese with about four times its weight of commercial muriatic acid, a yellowish green gas, termed chlorine, is evolved. It possesses a very powerful odour, and cannot be safely inspired, even when largely diluted with air. The gas can also be obtained by adding 5 parts of alum cake to 4 parts of bleaching powder, or chloride of lime; or, but in an impure, but equally efficacious, state, by the addition of one part of oil of vitriol to three parts of bleaching powder. A few crystals of potassic chlorate (chlorate of potash), placed in a saucerful of muriatic acid, slowly evolve chlorine.

Sulphurous Acid is prepared by burning sulphur. It is a colourless gas, and, like chlorine, cannot be breathed without injury to the lungs.

Muriatic Acid.—The acid liquid known in commerce by the name of spirits of salts, or muriatic acid, is water containing in solution about one-third of its weight of hydrochloric acid gas. By boiling the commercial article, the gas which it contains is, in great part, expelled, and it acts as a disinfectant of moderate power. The liquid also possesses disinfecting properties.

Condy's Liquid is a solution of permanganate of potassium in water. It acts by freely parting with a large proportion of the oxygen which it contains, when it comes in contact with organic matter, especially if the latter be in a decaying state. Although by no means so powerful as some other disinfectants, it possesses the great advantage of being without odour, and it is, therefore, well adapted for use in the sick room.

Carbolic Acid.—Pure carbolic acid is a white crystalline solid ; but the commercial article is a thin, tar-like liquid, with an odour resembling that of a mixture of tar and creosote. This substance acts by reason of its great antiseptic virtues. When mixed with animal or vegetable substances, it prevents them from fermenting or becoming putrescent ; but it allows them to undergo a very slow and harmless kind of decay, or oxidation, during which process no hurtful matters are evolved. It destroys animalcules and minute plants ; but in this respect it is excelled by other sanitary agents. There can be no question as to the valuable disinfecting properties of carbolic acid, and it is to be regretted that its odour is objectionable, and that so many accidents have occurred from persons drinking it in mistake for porter and other liquids. Tar, and tar oils, possess, but in a much feebler degree, the disinfecting properties of carbolic acid ; whilst picric acid and benzoic acid (a dear substance) are probably more powerful sanitary agents than carbolic acid.

Vinegar and ammonia, though used as disinfectants, are of but little value as such.

Sulphate of Copper (Bluestone or Blue Vitriol).—According to the recent experiments of Dr. Dougall, bluestone possesses germ-destroying and anti-putrefactive properties equal to those of chloride of aluminium : it differs from the latter, however, in being poisonous. Sulphate of copper instantly removes the odour of sulphuretted hydrogen.

Nitrate of Lead has been used as a disinfecting agent, but not largely. It rapidly removes the odour of sulphuretted hydrogen, and may be applied to foul sewage. This salt is poisonous.

Sulphate, Sulphite, and Chloride of Zinc are, especially the latter two, good disinfectants, particularly for sewage ; but they have the disadvantage of being poisonous. "Burnet's Solution" is simply chloride of zinc dissolved in water ; it may be easily prepared by dissolving pieces of zinc in muriatic acid.

Ferrous Sulphate (Sulphate of Iron, Copperas, or Green Vitriol) is the cheapest of the heavy metallic salts used for disinfecting purposes. It is applied to manure heaps and sewage ; but

it is not a powerful sanitary agent. Ferric chloride, or perchloride of iron, has been employed rather largely as a sewage deodorant. It is prepared by dissolving rust of iron in muriatic acid.

Bichromate of Potassium (bichromate of potash) is extolled as a disinfectant by Dr. Angus Smith—a distinguished sanitarian, and still more recently by Dr. Dougall: the latter says of chromic acid (prepared by adding sulphuric acid to bichromate of potassium) that its antiseptic power is double that of carbolic acid, and that “it must ere long take the foremost place as a sanitary agent.” I think, however, that chromic acid is hardly likely to become a cheap disinfectant.

Surgeon-Major O. Nial’s experiments with potassium chromate gave results similar to those of Dr. Dougall.

“*Bisulphite of Lime*” has been largely used as an antiseptic, but chiefly for the preservation of meat and other kinds of food. It has been highly commended by several chemists.

“*M. Dougall’s Powder*” is a compound of calcium sulphite (sulphite of lime) and carbolate of calcium (carbolate of lime). It is extensively used as a deodorant for sewage, stables, &c.

Alum, Lime, “Superphosphate of Magnesia,” and other earthy bodies, are, or have been, employed as disinfectants, chiefly in the case of sewage. Alum and other salts of the earth alumina appear on the whole to yield tolerably satisfactory results as sewage deodorants.

Charcoal in lumps has been found useful in absorbing foul gases from the air of dairies, stables, &c.

CHAPTER XVII.

SPREADING OF DISEASES AND HOW TO PREVENT IT.

A person suffering from a contagious disease is, with respect to the rest of the community, very much in the same condition as a lunatic—both are dangerous to health and life. They are, however, usually treated in a very different manner. The lunatic, if he exhibit the slightest tendency to do violence to any one, is, on the production of a medical certificate, summarily deprived of his liberty, and placed under such conditions as may be deemed necessary to prevent him from injuring any one. On the other hand, the small-pox or scarlatina patient is not interfered with. He may, when barely convalescent, mix, without let or hindrance, in crowds, travel in tram-cars, railways, carriages, and cabs, go to places of worship and amusement, and, in a word, scatter the seeds of disease

broadcast amongst the population. But it may be said that the law prohibits persons suffering from contagious diseases from exposing themselves in public. The 26th section of the Sanitary Act, 1866, certainly provides a penalty for such an act; but who ever heard of any one being prosecuted for a breach of this law. People are daily prosecuted all over the United Kingdom for allowing the existence of house nuisances, rooms to be overcrowded, tenement houses to be dilapidated; and but rarely, indeed, do we read of the prosecution of persons for spreading contagion amongst the people. Perhaps I may take an extreme view of this matter; but I hold that every person suffering from such a disease as small-pox should be deemed to be dangerous to the community, and should be placed under such conditions as would at least diminish the amount of mischief which such persons at present occasion. No doubt, any such interference with a patient would be considered by many a high-handed procedure, and an unwarrantable interference with the liberty of the subject; but there are few laws enacted for the well-being of the community that do not interfere with the so-called liberty of the subject. The liberty claimed for a scarlatina patient or convalescent is the liberty to freely communicate their disease to healthy persons, and that freedom is certainly one which the body politic, for its own sake, is justified in refusing.

There are great practical difficulties in the way of compulsorily isolating infected persons and the convalescent from contagious disease; but they are not insuperable. The law relative to exposure of persons affected with contagious disease should be strictly enforced. No person suffering from such maladies should be permitted to remain in any house containing more than one family, or in any dwelling in which there is not ample accommodation. The prompt removal of persons affected with contagious disease to hospital would materially lessen the current stock of contagion. With respect to convalescents, they should be detained until such time as their medical attendants pronounced them free from contagion, or at least not likely to be capable of communicating disease. Of course, convalescent hospitals should be provided in such cases; but the sanitary authorities have power to erect a sufficient number of these useful institutions. The immediate removal of the contagious sick, and their detention until free from contagion, I look upon as indispensable measures for the eradication of zymotic diseases. Clothing and bedding frequently are the media of propagating disease. Those belonging to persons who have died from small-pox, scarlatina, &c., are frequently sold or sent to the pawnbroker, without having previously been disinfected. In this way disease is often spread. Some years ago I discovered that the cast off straw from the patients' beds in a fever hospital was systematically sold, instead of being burned. No doubt, many poor persons who bought this fever-infected straw and lay upon it contracted the disease.

Lodgings and whole houses recently tenanted by persons affected with zymotic diseases are often immediately afterwards let to persons, without in the first instance thoroughly cleansing and disinfecting them. This is by no means an unusual mode of spreading disease. Housekeepers and others who allow persons to occupy rooms or houses recently the abode of persons affected with infectious disease, and which have not been disinfected, are liable to a penalty not exceeding £20 under Vic. 29 and 30, c. 90, sec. 39. Persons who sell infected clothing, bedding, or rags, and owners or drivers of cabs, or other public conveyances, who do not immediately disinfect their vehicles after conveying any sufferer from contagious disease, are liable to a penalty under section 38 of the same act; but except under very exceptional circumstances no public cab or other vehicle of the kind should be used for conveying the sufferers from contagious maladies. Besides, who is to see that the cab owner properly disinfects his vehicle. The operation should be performed for him at his own expense by the local sanitary authority. Section 24, Sanitary Act, 1866, enables local authorities to provide conveyances for the use of the sick.

There is little doubt but that in the majority of cases contagion is communicated by the sick or convalescent coming into direct or nearly direct contact with the healthy. In schools sick or recently recovered children infect their healthy fellow pupils with scarlatina, measles, and whooping cough. Nurses from hospitals convey contagion to their own homes, and to those of their friends. The laundress¹ disseminates the poison of scarlatina and small-pox amongst her employers. The tailor and dressmaker, working in their own wretched rooms, often ply their needles close to fever stricken patients. A case came under my own notice where a tailor, still suffering from small-pox, actually helped his father to make a suit of clothes which had to be finished within a limited time. It is a pity that the rich who have infected clothing and bedding do not burn them, instead of sending them to be washed, disinfected, or sold. Dr. Ogle mentions² several cases of scarlatina caught from infected clothing, and most physicians who have had much experience of zymotics can recall to mind instances of a similar kind. Dr. Grimshaw, who has devoted special attention to the subject of the spreading of contagious disease, relates³ that a patient with small-pox pustules on him, admitted into hospital, had on the previous day been occupied in dressing ladies' hair. "I have a butcher in the hospital who cut up four carcasses of beef after he had the pimples on him; I have a grocer who was attacked in his shop, and sold tea and sugar to the public with the rash on him; I have a

¹ For a remarkable account of a wide diffusion of scarlatina by the laundress, see a paper on the subject by Dr. Heslop, of Birmingham, in the *Lancet* for November 24, 1870.

² *Medical Times and Gazette*, November 26th, 1874.

³ *Dublin Medical Journal* for March, 1872; page 223.

telegraph clerk who was working in the post-office after the eruption was out on him. With such things as these occurring it is no wonder that the disease (small-pox) is spreading in every direction."

Rags are popularly supposed to be a common vehicle of contagion; but the investigations¹ of Dr. Bristowe gave results to a great extent negative of this belief. At the same time, rags are occasionally, no doubt, the means of infecting those persons in paper mills who are engaged in sorting them.

Scarlatina is one of those diseases the most difficult to be dealt with by preventive medicine. It appears almost as frequently amongst the rich as the poor—in clean houses as in filthy dwellings. The mortality from the disease is high; and its contagium is of a most persistent character, retaining its mischief-working powers for many months after it has been cast forth like an unclean spirit from the bodies of the diseased. *Scarlatina* is eminently contagious, and its poison is evolved in large quantities from the bodies of the sufferers from it: the only means, therefore, which are likely to lessen the ravages of this malady are (1) the strictest isolation of the sick, and the only somewhat less strict isolation of those who directly minister to their wants; (2) the prompt and utter destruction of every article of clothing, and bedding, of napkins, wall paper, and upholstery, &c., which might possibly contain the contagium of the disease. In the case of the wealthy, these preventive measures (against fresh attacks) are practicable; in that of the poor they are very difficult, though, perhaps, not impossible. The poor cannot afford to sacrifice their clothing and bedding; but why not indemnify them for the loss? I fear the local authorities are not yet sufficiently appreciative of the advantages of preventive measures to be prepared to offer the full value for all the infected clothing voluntarily surrendered for destruction. With respect to the isolation of poor persons suffering from scarlatina and small-pox, the law empowers the local authorities to remove them to hospital from their houses when the latter are not in a proper condition—are they ever in a proper condition?—for the reception of the sick. This law ought certainly to be enforced with the utmost vigour. The inspectors of nuisances should ascertain whether or not scarlatina had appeared in any school within their districts; and if it had, to promptly apprize the medical officer of health of the fact. The latter should lose no time in causing the school to be closed or disinfected, or subjected to such other measures as he might think necessary.

Until very recently scarlatina was unknown in India, but the poison was introduced into that country three years ago, and is probably now spreading throughout it. The manner in which zymotic diseases are spreading in new countries by the agency of man and mer-

¹ Report of Medical Officer of the Privy Council for 1865; page 196 *et seq.*

chandise is very remarkable. We shall send sooner or later cholera to Australia, just as we have introduced rinderpest into that country. The recent appearance of scarlatina in India is not without its lesson; for as Sir Thomas Watson remarks, "Considering the previous freedom from scarlatina of that large portion of the habitable earth, the date of what may prove to have been its earliest infection is worth noting; and the truth which it helps to enforce is worth repeating—namely, that, like small-pox, measles, &c., scarlatina does not arise now-a-days except from contagion."

Small-pox poison is not so persistent as that of scarlatina, but the disease is extremely contagious. The contagium appears to be propagated in a manner closely resembling the spreading of scarlatina poison—namely, by direct contact between the sick and sound, and by the media of clothing, bedding, furniture, wall paper, &c. There is no proof to show that it is spread by foul water or sewer gases. The isolation of the sick and the destruction or thorough disinfection of their clothes, &c., together with vaccination, are the obvious measures for the prevention of small-pox. Preventive measures may appear to be harsh; but let us consider that if by them we were enabled to extirpate zymotic disease, one out of every five deaths that now annually occur in the United Kingdom would be prevented. For such a saving of human life almost no temporary sacrifice of liberty or expenditure of money could be too great.

Typhus fever has a weaker and a less persistent poison than scarlatina. It does not seem to be generally, if at all, propagated by foul water. Perhaps it is by sewer gases, but certainly not to a large extent. The contagium does not appear to travel far through the air, nor to be very portable. The danger of infection diminishes as the distance between the sick and sound increases. Every one appears to be susceptible to the poison, but rarely to be affected twice by it. Dr. Russell, an eminent authority on this disease, states that every one connected with the Glasgow Fever Hospital contracts the disease sooner or later. Those attending on the patients are the earliest affected, those remotest from them—the gate-keepers, bread-room men, &c.—the last to succumb. It is most likely that the poison of typhus is not of common sporadic origin, but that it is propagated from individual to individual. It is that zymotic most likely to disappear first under an improved hygienic condition of the population and the more rigorous application of sanitary laws. Attention to cleanliness of the person, clothing, furniture, and dwelling, and liberal dietaries, lessen the spread of typhus. Isolation of the affected not merely from the healthy, but also from each other, is most desirable. If it were possible, it would be better to treat *every* case of typhus in a large and airy room set apart for the purpose. The crowding together of typhus patients is disastrous.

Relapsing fever is a disease of uncertain origin. It is contagious, and appears to be a close congener of typhus, though differing from the latter in many of its more prominent symptoms.

The influence of the insanitary conditions of the common lodging houses in spreading the disease is strikingly shown by the following figures :—¹

TABLE SHOWING COMPARATIVE SICK-RATE IN THE THREE SUB-DISTRICTS (OF ST. GILES) AND IN COMMON LODGING HOUSES.

Sub-districts.	Population.	Cases.	Ratios.
St. George, Bloomsbury ...	17,392	7	1 in 2,484
St. Giles, South	17,940	72	1 in 249
St. Giles, North	16,578	44	1 in 377
Common Lodging Houses	2,177	97	1 in 22·4

The results of the inquiries of Dr. Russell, Dr. Ross, and of other investigators show that relapsing fever prevails exclusively amongst the very lowest classes of the population. As a general rule, privation is a precursor and an accompaniment of the disease, which, indeed, has been termed in Germany and elsewhere, "famine fever."² Mere poverty does not appear to induce the disease, seeing that costermongers and labourers escape. Absolute want, or actual dearth of nutriment, is, with rare exceptions, the immediate precursor of each attack. When the relapsing fever was established in a locality, the effect of overcrowding in human habitations in spreading the disease became very evident. When it visited a numerous family, it rarely happened that fewer than two members suffered, and very frequently all the children in a family were attacked.

Dr. Ross ascertained that there were no apparent relations between the spread of relapsing fever and the temperature or humidity of the atmosphere. As cold lowers the vital powers of persons insufficiently fed, I should have supposed *a priori* that a low temperature would have increased the amount of the disease.

The rate of mortality from relapsing fever in Dr. Ross's district was only two and a half per cent., whereas in some other places it amounted to about ten per cent. This small mortality appears to have been due to the prompt sanitary measures employed; but more especially to the instant removal of the sick to the hospitals, where they received not only medicine, but good food. During the recent epidemic of small-pox in Dublin great efforts were made to secure the prompt removal of fever patients to hospital. Every

¹ Extracted from the report of an epidemic of relapsing fever in St. Giles, London, in 1870.

² Virehow, of Berlin, describes it as "*die hunger-pest*."

morning a sanitary sergeant of police called upon each dispensary physician, and ascertained from him the names and address of those of his patients who were affected with any zymotic disease. The information thus obtained was acted upon at once, and the patient was, if at all possible, immediately conveyed to the hospital, and the apartment in which he had lived was disinfected. The great difficulty was to disinfect the clothes of the persons who lived with the sick. Amongst the poorer classes a change of raiment is the exception, not the rule. To provide them with new clothes is somewhat expensive, and the public health authorities are not likely to be induced to sanction any large expenditure for such a purpose. Nevertheless, it is probable that what might appear to be the most expensive method of endeavouring to "stamp out" or greatly lessen zymotic disease would in the end be the cheapest plan. The rinderpest was extirpated in England and Scotland by the most expensive method that could possibly be adopted—namely, the instant destruction of every animal that exhibited the first symptoms of the disease. Thousands of animals were killed, but with them also perished the disease.

Measles, belonging as it does to the *Exanthemata*, resembles generally in its mode of propagation the other members of that group of diseases. Although very common in childhood, no age exempts us from this disease. It is highly contagious; and the measures necessary to prevent the spreading of it are similar to those to be employed in the case of small-pox. As a rule, however, very few consider it necessary to disinfect the clothing, &c., which had been in contact with persons affected by measles. It is probable that attacks of such comparatively mild zymotics as measles may help to render persons somewhat less susceptible to the poison of all the contagious maladies. When a zymotic first appears amongst a savage or semi-civilised people—the natives of the South Sea Islands &c.—its ravages are usually very severe, and this severity has been attributed to the circumstances that such people had not in their infancy been affected with measles, chicken-pox, whooping cough, &c. The latter not improbably use up some of the stock of that peculiar constituent in the blood which seems to be susceptible to the influence of zymotic ferments; but, of course, these are merely speculations.

Whooping Cough is very contagious, and children suffering from it should be isolated as much as possible. The disease, though, on the whole, mild, occasionally proves fatal.

Asiatic cholera is spread, undoubtedly, through the medium of impure water, probably by soiled clothes and bedding, perhaps by polluted air from sewers and soils. Its poison does not seem, however, to be generally propagated directly through the air; and, therefore, the disease is not usually contracted at the bedsides of the cholera sick. In this respect cholera resembles typhoid fever, and both diseases appear to be similarly propagated. The immense preponderance of opinion, worth having, is in favour of the

view that cholera does not originate in Europe, and that the disease is communicated from individual to individual, and by that mode alone. Whether or not it originates now-a-days in India is a wide question, unnecessary to discuss here.

Although the cause of cholera remains unknown, the contagious nature of the disease and the various channels by which it is communicated appear to have been very clearly ascertained. Cholera, like all the diseases of its class, may be fairly met with hygienic weapons. "It cannot," says Mr. Simon, the medical officer of the Privy Council, "be too distinctly understood that the person who contracts cholera in this country is, *ipso facto*, demonstrated with almost absolute certainty to have been exposed to excremental pollution; that that which gave him cholera was (mediately or immediately), discharged from another's bowels; that, in short, the diffusion of cholera amongst us depends *entirely* upon the numerous filthy facilities which we let exist, and especially in our larger towns, for the fouling of earth, air, and water; and thus, secondarily, for the infection of man and whatever contagion may be obtained in the miscellaneous outflowings of the population."

On the subject of cholera the following observations, made by Professor Pettenkofer—to whose investigations into the etiology of this disease we are so much indebted—will be read with interest:—

"In my opinion four conditions are essential in order to bring about an epidemic of cholera:—

1. A specific germ.
2. Certain local conditions.
3. Certain seasonal conditions.
4. Certain individual conditions.

I have not investigated the nature of the cholera germ as disseminated by human intercourse. I have only taken for granted that it exists in the intestinal discharges of persons coming from infected places. My own investigations have been chiefly confined to the second and third before-mentioned conditions. Hitherto I have considered the human subject only so far as he is the bearer of the infecting matter of cholera or of the germ of this matter; and have with facts contended against the pure contagionists, who declare that the infecting matter is produced by a process of multiplication within the bodies of those affected by the disease. My chief proofs of this have always lain in simple *facts* (independent of any theory) as to the spread of cholera over large districts. There are certainly *places* enjoying complete immunity from cholera, also *periods* of immunity. The development of epidemics, and the immunity of many places, is totally inexplicable by the simple assumption of contagion from person to person. Observe the spread of epidemics along the course of railways and other ways of intercommunication. Nor are they to be explained by certain individual disposition of person (food, drinks, domestic arrangements, age, position, &c.); but the circumstances require, besides these, the existence of local and seasonal aiding causes, which have to be assumed.

Are these in immediate relation to the cholera germ itself, or to the individual disposition? Facts speak in favour of the first opinion only.

1. Persons from an unaffected place going to an affected one are attacked quite as numerously and as soon as the persons who constantly reside in these places. 2. Cases are on record where a person from an infected district conveys (in a way not clearly ascertained) infecting matter to a place enjoying complete immunity from cholera; and there, by means of his limited

amount of infecting matter, infects a few persons who themselves had never been subject to the local conditions of an infected place, and therefore could not have had their individual disposition altered by it. Facts imperiously demand that we should consider that the "seasonal" and "local" conditions are intimately connected with the cholera germ, although they may, in addition, be in a condition to act on the predisposition also.

The infecting matter, in my opinion, is not a product of the human intestines, but of the soil. In so far as we consider the cholera germ of an organised nature, and capable of various degrees of development, it is possible—nay, very probable—that there may be various degrees of infection. The distinction between cholera "germ" and cholera "infecting matter" must be noted. The cholera germ stands in the same relation to the infecting matter as the seed does to the fully developed plant.

The correctness of these views (Pettenkofer's) is disputed by Dr. Buchanan, who, from his position of Government Sanitary Inspector, has had peculiar facilities for investigating the conditions under which cholera spread in England during the recent epidemic of that disease. Dr. Buchanan believes that cholera and enteric fever are communicated chiefly through the medium of polluted water. Pettenkofer states that when the soil water is lowered the cholera poison diffuses itself throughout the porous soil; but, according to Buchanan, when the soil water subsides, the superficial wells become more impure from effete animal matters; and the drinking water which they supply is the direct carrier of the disease. It is evident that when the soil water is nearly up to the surface of the ground the waste matters thrown out from dwellings are carried off horizontally by the drainage; whilst, when the soil water is low, the refuse sinks into the surface wells, which thereby become polluted, and during epidemics of cholera, or endemics of enteric fever, retain the virus of those diseases. Dr. Buchanan quotes several facts to prove that typhoid fever is spread by means of polluted potable water; and he endeavours to prove that the subsidence of soil water does not affect the spread of the disease in localities supplied with water brought from pure and remote sources. I quite agree with Dr. Buchanan in regarding impure drinkable water as a common vehicle in which the germs of several zymotic diseases are carried into the body. During the last epidemic cholera in Ireland I found that the pump water used in several localities where the disease was unusually severe contained excessive amounts of animal impurities. This was particularly the case with Arklow and Mallow. In the latter town there were few cases of the disease except in one suburb, the well water of which I found loaded with organic matter, nitrates, nitrites, and ammonia. Where the disease did not prevail the water was remarkably pure. Dr. Buchanan's views are greatly strengthened by the fact set forth in Ballot's report on the spread of cholera in Holland; for that author has shown that in every town in the Netherlands where rain water alone was drunk there were either no cases of cholera or a few isolated ones. On the other hand, where wells and canals furnished the water of towns or villages the disease prevailed. Pettenkofer himself does not deny the fact that cholera

and typhoid fever are occasionally contracted by drinking impure water. In 1870 I had the pleasure of conversing with Professor Pettenkofer upon this and other subjects, and he stated that he believed cholera was occasionally communicated through the agency of potable water, but that the general spread of the disease was not through that channel.

The most striking fact adduced by Dr. Buchanan against the most important part of Pettenkofer's theory is that, whilst main drainage works were carried on in seven large towns the mortality from enteric fever actually declined. These towns were supplied with water from a distance, and therefore the subsidence of the drainage only affected the wells, from which no important part of the water supplies of the town was derived.

The following shows the mortality from enteric fever in each town before and during the years when the soil water was sinking, the figures representing in each case a death-rate per 10,000 of population yearly:—

	Before.	During.
Bristol,	10	8
Leicester,	15	$10\frac{1}{3}$
Merthyr,	$12\frac{2}{3}$	$8\frac{2}{3}$
Cardiff,	$17\frac{1}{2}$	$4\frac{1}{2}$
Carlisle,	10	$8\frac{2}{3}$
Macclesfield,	$14\frac{1}{4}$	14
Newport,	13	$12\frac{1}{4}$

Of these towns the lowering of soil water was most considerable in the cases of Leicester and Cardiff. It may be well that I should guard against misapprehension by stating that, in the period after the execution of the works here considered, the reduction of mortality from enteric fever was, with scarcely an exception, greatly more conspicuous than in the time during which the works were being done.

It appears, then, from the experience of these seven large towns, that when lowering of soil water is brought about, while drinking water is being supplied, not from the soil of the place, but from pure external sources, Pettenkofer's experiences, obtained from places which do derive their water supply from their own soil, fail of application. It is probable that if closer inquiry were made into the sequence of sanitary improvements, some or all of the towns which were first set aside might afford further evidence adverse to the general expression of facts given by Pettenkofer—at all events, none of these towns afford any colour to the supposition that sinking of soil water exercised appreciable evil effect against the good effects that were being gained in other ways.

The three towns which I have left for further mention are Croydon and Worthing, where, during the years of soil-water reduction, there was an increase of fever; and Stratford-on-Avon, where, with considerable reduction in the level of soil water, great reduction of fever also took place, and this although the source of water supply remained what it had always been—the porous ground upon which the town stands. The case of Stratford is the only one which appears to me antagonistic to the whole of Pettenkofer's theory. Its fever death-rate was $12\frac{1}{3}$ yearly before drainage works were begun in 1854. The construction of the sewers reduced the level of the subsoil water, intercepting springs, and drying wells, many of which had to be deepened. Yet, while these works were going on, the annual fever death-rate was only $5\frac{3}{4}$. The other two instances, Croydon and Worthing, appear at first sight to bear out Pettenkofer's views in their entirety, for both of them having pure water supplied to them from sources out of the reach of contamination, got their soil water much reduced during the time that cer-

tain drainage works were being made, and at the same time got a considerable increase of fever; in the case of Croydon from $16\frac{1}{2}$ to 19 per 10,000, and in the case of Worthing from $7\frac{1}{2}$ to $9\frac{1}{2}$. But in each of these places it is known that arrangements intended for the removal of excrement had for their result the free discharge of sewer gas into houses, and the evidence connecting the outbreaks of enteric fever with this defect is so conclusive as to obscure altogether any causative conditions relating to the soil.

Admitting, then, Professor von Pettenkofer's thesis that subsidence of soil water is a condition favourable to the epidemic prevalence of enteric fever, I think it has been shown that the qualification is wanted "where in the town or place the supply of drinking water is derived from the soil upon which the town stands;" and then the conditions to which Pettenkofer calls attention will range themselves under the more general etiological head of circumstances assisting in defiling supplies of drinking water. I have not much doubt that what is true, in this regard, for enteric fever is also, in its degree, true for cholera; but upon this point, remembering the varied character of the statements connecting cholera with soil, and feeling the need of wider and more exact experience, I cannot venture to speak with certainty.

Dr. De Renzy¹ minutely examines the theory of cholera propagation proposed by Pettenkofer, but concludes that it "gives no assistance in interpreting the phenomena of cholera in the Punjab." Dr. De Renzy also dissents from Dr. Bryden's theory, which has to a great extent been accepted and acted upon by the Indian Government. This theory is as follows:—

That the cholera virus is generated in the soil of certain districts in the Lower Provinces, where it has a permanent perennial existence; that from time to time it is thence carried by moist air as its vehicle to the Upper Provinces, where it has no permanent existence, but dies out after a period of usually four years, to be renewed after an interval by invasion from the Lower Provinces; that during its vital period it becomes dormant for a certain interval each year; that by observation of the natural laws which control it, we are able to define to a day when a dormant or latent cholera shall reappear; that certain areas are occupied by cholera in each year, while others are free from its presence; that thus parallels are formed, from the study of which we can tell beforehand what will be the geographical distribution of an epidemic; that as these parallels occur in complete subordination to meteorological influences, epidemic cholera is never in any case spread over a definite geographical area by human intercourse, nor can human agency cause the boundaries of a natural province which has been occupied to be transgressed; that a humid atmosphere is in all cases required as the vehicle of cholera, and that the prevailing wind directs its progress; that, nevertheless, cases of cholera occur by transmission from those who have been subject to the choleraic influence, or from fomites impregnated with the choleraic virus, but that no aggregate of cases so originated has ever produced a provincial manifestation of cholera.

Dr. De Renzy argues that cholera contagium is propagated chiefly by means of contaminated water. In this opinion he agrees with Dr. C. Macnamara, who states that "if we can only establish the principle that nothing but freshly and properly filtered water shall be consumed by the inhabitants of a town, barrack, or house, not only when at home, but when at work—at all times, in fact, when cholera is abroad—we may, I believe, discard all and every other means of preservation. Cholera cannot possibly gain a hold

¹ Report on the Sanitary Administration of the Punjab, 1868. Lawrence Press, Lahore, 1868; also for 1869.

on any country, village, or home protected in this way. Measures of hygiene beyond are, of course, most useful in many ways, but they will not stop cholera, or, in fact, control its extension one iota, if the means above indicated be neglected. If the water supply is a matter of importance in a country like England, what must it be in the case of the drinking water in the endemic area of cholera?" The reasoning of Dr. De Renzy, and the strong facts with which he enforces his arguments, certainly to my mind are very convincing. That foul water is a common proximate cause of cholera is a fact of which I have long since convinced myself from actual observation. If, then, water is a common medium of propagating cholera in these countries, how much more frequently must not the disease be communicated in this manner in India, where the water supplies are notoriously largely contaminated with effete animal matter?

The International Sanitary Congress, which met this year (1874) at Vienna, considered the questions of the origin and propagation of cholera. They arrived almost unanimously at the following resolutions:—

I. *Endemicity and Epidemicity of this Disease in India.*—Asiatic cholera, susceptible of spreading (epidemically), is spontaneously developed in India, and when it breaks out in other countries, it has always been introduced from without. It is not endemic in any other country but India.

II. *Questions of Transmissibility.*—1. *Transmissibility by Man.*—Cholera is transmissible by man coming from an infected medium; but man is not considered as the specific cause, apart from the influence of locality; he is regarded as the propagator of cholera when he comes from a place where the germ of the disease already exists.

2. *Transmissibility by Clothing, Linen, Bedding, &c.*—Cholera can be transmitted by personal effects coming from an infected place, especially such as have served for the sick from cholera; and certain facts show that the disease can be carried to a distance by these effects if shut up so as to prevent free contact with the air.

3. *Transmissibility by Foods and Drinks.*—(a) *Foods.*—The conference not having conclusive proofs of the transmission of cholera by foods, decided by eleven states against seven that it was not justified in coming to a decision on this question.

(b) *Drinks.*—Cholera can be propagated by drinks, particularly by water.

4. *Transmissibility by Animals.*—No proof exists of the transmissibility of cholera by animals, but it is reasonable to admit the possibility of such transmission.

5. *Transmissibility by Merchandise.*—Although proof is wanting of the transmission of cholera by merchandise, the possibility of such transmission in certain conditions should be admitted.

6. *Transmissibility by Cholera Corpses.*—Although it is not proved that cholera corpses can transmit cholera, it is prudent to consider them dangerous.

7. *Transmissibility by the Atmosphere alone.*—No fact is yet known which proves that cholera can be propagated to a distance by the atmosphere alone, whatever its condition. Moreover, it is a law, without exception, that an epidemic of cholera is not propagated from one place to another in a shorter space of time than it takes man to travel.

The surrounding air is the principal vehicle of the generative agent of cholera; but the transmission of the malady by the atmosphere, in the immense majority of cases, is restricted to the close vicinity of the focus of emission. As to facts asserted of transportation to a distance of one or many miles, they are not conclusive.

8. *Action of the Air upon the Transmissibility.*—It results from a study of the facts that in free air the generative principle of cholera rapidly loses its morbid activity; but that in certain conditions of confinement this activity may be preserved during an undetermined time. Great deserts form a very efficacious barrier against the propagation of cholera. This disease has never been imported into Egypt or Syria, across the desert, by caravans from Mecca.

III. *Duration of Incubation.*—In almost every case the period of incubation—that is to say, the time which elapses from the moment when an individual has contracted the choleraic intoxication to the commencement of the premonitory diarrhœa or of confirmed cholera—does not exceed a few days. All the facts cited of a more prolonged period of incubation refer to cases which either are not conclusive, or in which the premonitory diarrhœa has been included in the period of incubation, or in which contamination (the contraction of the choleraic intoxication) has occurred after departure from the infected place.

Observation shows that the duration of the choleraic diarrhœa called premonitory—which must not be confounded with other kinds of diarrhœa that may exist where cholera prevails—does not exceed a few days.

The facts instanced as exceptional do not prove that cases of diarrhœa of lengthened duration belong to cholera and are susceptible of transmitting the malady, when the person affected is removed from all cause of (choleraic) contamination.

IV. *Questions as to Disinfection.*—Are any means or processes of disinfection known by which the generative or contagious principle of cholera can be *certainly* destroyed or deprived of its intensity?

Are any means or processes of disinfection known by which the generative or contagious principle of cholera can *with some chance of success* be destroyed or deprived of its intensity?

Science does not yet know any certain and specific measures of disinfection; but the great value of hygienic measures, such as ventilation, thorough cleansing, &c., is to be recognized, combined with the use of the substances regarded as disinfectants.

Typhoid fever is propagated by means similar to those that cause

the spread of cholera, as has been shown in the chapter on water, and will be further exemplified in the chapter on diseased and unsound food and drink.

Prevention of Venereal Disease.—Public opinion in Great Britain and Ireland is rapidly coinciding with the views of those sanitarians who advocate legislative means for the purpose of arresting the spread of contagious venereal diseases. A few years ago he who would venture to suggest the desirability of state interference in such a matter would be scouted by the non-medical section of the community; but the enormous physical evils which result from untrammelled prostitution are now so patent that all save the most prejudiced admit that they demand a prompt remedy. If the non-recognition of the "social evil" could tend in any way to lessen the vice, there would be some excuse for those whose over-prudishness leads them to object to any interference with prostitutes on the part of the state. But the history of all nations shows that both the moral and physical evils arising from prostitution have been increased instead of lessened by allowing the unhappy creatures who ply this dreadful trade to remain free from the *surveillance* of the authorities. Efforts have been made from time to time in most civilized countries to eradicate prostitution, but not only did all those attempts prove failures, but they actually, in many instances, induced a general corruption of morals. In the year 1845 all the brothels in Berlin and others of the large Prussian towns were forcibly closed by order of the king, and public prostitution was proscribed under severe penalties throughout the kingdom. Very soon the results of this system became apparent. Illegal prostitution rapidly spread. The public morals became worse than ever. The number of illegitimate children increased. There appeared to be a general profligacy pervading all ranks of society; and finally venereal disease became more virulent and widespread. After six years' experience of this method of stamping out prostitution, the king was prevailed upon to repeal his edict and to allow the re-establishment of brothels under the *surveillance* of the authorities. Since 1851 women openly leading unvirtuous lives in Berlin are placed under strict control, and they are periodically inspected by medical men appointed for the purpose. The same system prevails in most parts of the continent. Berlin appears to be a very hot-bed of prostitution, for, according to Dr. Straysma, it contained in 1869 23,855 unfortunates, or 11 per cent. of the female population between the ages of 14 and 60.

The Contagious Diseases Prevention Acts were passed with the view of protecting the soldiers and sailors from venereal disease. Certain districts are specified in the Act, within the limits of which women who are known to be prostitutes are placed under the supervision of the police, and are obliged to submit to periodical medical examinations. If found to be suffering from venereal disease they are sent to hospital and detained there until

cured. This system has been for some time in operation at the principal military and naval stations in England, and with the best results, as has been clearly shown in the Report of the Select Committee of the House of Lords on the "Contagious Diseases Prevention Act," and the reports of the medical authorities.

I trust that the operations of the "Contagious Diseases Prevention Acts" may be extended to the civil population of these countries, amongst whom they would prove as beneficial as they have already in the case of soldiers and sailors. In the interests of the unfortunate women, as well as of the whole community, I express this hope. Those engaged in carrying out the workings of the Acts assure us that they have been productive of moral as well as physical benefit to these unhappy creatures, many of them having, under the influence of hospital discipline, been reformed and restored to their friends. In Japan, where prostitution is a recognized though not respectable occupation, those engaged in it are placed under police supervision; and we learn from an interesting Report, prepared by Mr. George Newton, a surgeon in the Royal Navy, that the Japanese Government has recently established a lock hospital at Yokohamma, and provided it with 150 beds. Here the women are compulsorily examined and detained if found to be diseased. When we find such a State as that of Japan adopting a system of compulsory examination of prostitutes, and providing for their treatment so large an hospital, we surely have a right to expect our Government to do something to prevent the spread of the most loathsome of diseases amongst us.

The opponents of these Acts allege that they are wholly useless as a means of preventing the spread of syphilis, whilst they lead to frequent outrages on the modesty of perfectly chaste women. I rather incline to the opinion that the extension of the provisions of these Acts, so as to include the whole population of the country, would be likely to lessen the amount of syphilitic poison in circulation throughout the whole country; but whether or not the cause of morality would be at the same time promoted is not quite so evident. The credible evidence which has been taken relative to the practical working of these Acts certainly fails in proving that respectable women have anything to fear from them. The great question, however, is whether or not a complete system of supervision of prostitutes would be likely to diminish venereal disease. It is stated that such a system has proved an utter failure in Paris and other large cities where there are the strictest laws in relation to the control of prostitution.

In Lecour's work on Prostitution, published in 1870, he states that the total number of prostitutes registered in Paris in 1869 amounted to 3,731, whilst the number of those "in circulation," but not registered, was 2,782. In 1865 the registered prostitutes numbered 4,225, and those known to be unchaste, but who were not registered, amounted to 3,313. It would appear that under police regime the brothels of Paris and their inmates are declin-

ing in number, whilst the population of the city has been steadily increasing. M. Le Fort, a French surgeon, who has been much occupied in organizing the system of prostitution inspection in Paris, states that he believes the actual number of women who make a "traffic of their persons" is from 40,000 to 50,000. These numbers are too high; for if we assume the latter to be the true one, then it would make every fortieth female in Paris a prostitute. If, then, the venereal disease prevention laws in force in Paris fail in bringing under subversion perhaps from 70 to 90 per cent. of the "unfortunates" of that city, it may be argued would the British contagious disease laws prove more successful if they were extended to the whole population? Dr. Chapman and others assert that they would not prove more successful, and they argue that its sole effect would be to increase the amount of what has been termed "clandestine prostitution." In Dublin there is certainly a large amount of syphilitic poison present amongst the lowest class of unfortunates, and it can hardly be doubted but that the enforced surveillance of those persons would soon lessen the spread of disease. In towns of moderate size clandestine prostitution is not so difficult of detection as in such immense cities as Paris and London. Even if the Contagious Diseases Acts failed in their application to centres of large population, they might prove useful in the numerous moderate-sized and small towns of these countries.

CHAPTER XVIII.

CONSTRUCTION OF HOSPITALS.

It is not improbable that the hospitals of the last century increased the death-rate of the population, instead of diminishing it. They were small, overcrowded, ill-kept and badly ventilated; the patients were not classified according to their maladies—phthisical and fever patients were placed side by side. The dietaries were insufficient, and the nurses too often brutal and ignorant. Smollett (himself a physician) has given us, in chapter xxv. of "*Roderick Random*," the following description—I have no doubt a perfectly truthful one—of a naval hospital of the last century:—"Here I saw about 50 miserable distempered wretches, suspended in rows, so huddled one upon another that not more than 14 inches space was allowed for each with his bed and bedding; and deprived of the light of the day as well as of fresh air; breathing nothing but a noisome atmosphere of the morbid steams exhaling from their own excrements and diseased bodies, devoured with vermin hatched in the filth that surrounded them, and destitute of every convenience necessary for people in that helpless condition."

No doubt, the hospitals for soldiers and for the civil population were not in a much better condition than the noisome den so graphically described by Smollett. In the *Hotel Dieu*, a famous Paris hospital, the wards were so overcrowded that there was hardly one bed for every six persons. The patients enjoyed by turns the luxury of a bed, and when not, its occupant had to rest—if rest it could be called—on benches. Can we wonder that one out of every four patients died? The condition of London and Dublin hospitals was not much better. In the surgical infirmaries the mortality was frightfully high, the majority of persons on whom the major operations were performed died, not from the mere operation itself, but from blood-poisoning caused by the foul air of the place.

If density of population be a factor in producing a high death-rate, surely the crowding of the sick must be the very worst form of human "density." The statistics of the mortality of hospitals, taken in connection with their construction formerly and lately, admit of but one inference—namely, that the excessive aggregation of the sick is a serious cause of mortality amongst them. It might be urged that if this be the case it would be better to substitute for the hospital some other and more efficacious mode of alleviating human suffering in disease; but no such mode likely to be efficacious has been suggested. Hospitals are adjuncts of our civilisation, and cannot be dispensed with; but we should adopt, in their construction, every means likely to promote their object—the cure of disease. There is not wanting plenty of advice on this subject; and whilst a variety of opinions on the details of "sanitary architecture" prevails, every one is agreed that in hospitals abundance of pure air and ample cubical space are prime requisites.

The microscopical examination of the solid matters floating in the atmosphere of hospitals, and the dust on its walls and recesses, have not afforded pleasant results. Drs. Dundas Thompson and Rainey found in the air of a ward in St. Thomas's Hospital, London, occupied by cholera patients, sporules, vibriones, in an active state, confervoid fungi, hairs, wool, cotton, &c.¹

Reveil and Chalvet² found, independently, large quantities of epithelial cells and organic corpuscles in the air of surgical wards of the hospital of St. Louis, Paris.

Dr. Watson found, in the air of a phthisical ward, bodies resembling the degenerate cells of tubercle.

M. Lemane³ examined the air of several hospitals, and found in the moisture condensed from it, and the air itself, numerous

¹ *Annales D'Hygiene Publique*, July, 1862; and *Revue Médicale*, for June 30th, 1866.

² Report of the Committee for Scientific Enquiries in relation to the Cholera Epidemic of 1854. P. 121.

³ Parkes' *Manual of Hygiene*. 4th edition.

bacteria, monads, and vibriones, fungoid bodies, and oval and round diaphanous bodies.¹ Such bodies may not be the cause of any disease, but their presence in the atmosphere of a hospital ward is an evidence of imperfect ventilation; besides, there is a possibility that some of these low forms of life may be connected, in some way, with the spread of contagious diseases.

The term *hospitalism* has been applied to the aggregate evils incidental (at present) to the treatment of the sick in hospitals. The late Sir James Simpson, of Edinburgh, Dr. Evory Kennedy, of Dublin, and Miss Nightingale have each fully discussed the subject. Sir James Simpson collected statistics of amputations of limbs performed in town hospitals, in small ones in country places, and in private practice. He found that the mortality after these operations in the city large hospitals was more than double that attendant on the operations performed in small hospitals in the country and in villages. In hospitals of from 300 to 600 beds the mortality was 40 per cent.; in those having from 100 to 300 beds 25 per cent.; in those with from 25 to 100 beds 13·5 per cent.; in cottage hospitals, of less than 8 beds, 2 deaths follows 75 operations; and in private practice in the country 1 in 9 operated on die. In 9 London hospitals the deaths, after amputation of the thigh, were in the ratio of 46 per cent.—an excessive mortality. In American hospitals—which are smaller than those in London—the mortality after amputation of the thigh is in the ratio of 34·41 per cent.²

Dr. Evory Kennedy, of Dublin, in an elaborate paper read before the Obstetrical Society in 1869, showed that the deaths in the Rotundo Lying-in Hospital averaged, since its foundation, 1 per 72 patients. In some years the deaths were very numerous, and in one they were in the ratio of 14 per 100 patients. The deaths in England and Wales from childbirth and its *sequelæ*, during a long series of years, averaged 1 in 223, in Scotland 1 in 225, and in London 1 in 239 cases. Dr. Kennedy believes that the high mortality in the Rotundo Hospital is chiefly due to puerperal fever, the contagious matter of which is never absent from the institution, owing to the large number of patients treated in it, and who are continuously adding to the stock of puerperal poison. He suggests that parturient women should be treated in cottage hospitals, each containing not more than 2 beds. By this plan he conceives that the mortality from metria would be greatly diminished. The following are some of Dr. Kennedy's conclusions in reference to metria contagion:—

That this poison may be generated by any parturient female; and where the circumstances are favourable to its imbibition it may be absorbed

¹ Recherches Clinique et Experimentales sur les Maladies Infeetense. Par MM. Coze et Filly. Paris, 1872. Also Comptes Rendus for October, 1868.

² Amputations at the Massachusetts General Hospital. By Dr. James Chadwick. 1871.

into the system of the generator or that of any other parturient female exposed to its influence.

That the generation and absorption of this contagion is in a direct proportion to the number of parturient females cohabiting at their parturient period, or who breathe the same atmosphere when lying-in.

That in lying-in hospitals, where large numbers of patients are delivered under the same roof, this disease finds its habitat, appearing and reappearing at uncertain intervals.

That its appearance, although apparently capricious, is not infrequently traceable to the occurrence of other zymotic diseases, to a general unhealthy state of the hospital, the labours, for some time being succeeded by bad recoveries before the true zymotic metria exhibits itself.¹

The opinion of the great majority of obstetric practitioners in Dublin does not coincide with that of Dr. Kennedy respecting the malign influence of hospitals in producing metria. Drs. Kidd and Ringland state that in the Coombe Maternity the deaths from puerperal fever during a period of 15 years were in the ratio of 1 in 119·509 cases. They however admitted that metria was contagious, and that where it did break out it spread rapidly amongst the patients. The Coombe Lying-in Hospital has recently been rebuilt in great part, and now consists of two buildings, perfectly isolated from each other. Should metria appear in one of these buildings it can be closed at once, another being available for the patients.

Dr. Churchill tells us that in some small lying-in hospitals the deaths are numerous—Edinburgh Hospital (3,824 cases), 1 in 61 cases; the British Lying-in-Hospital (2,438 cases), 1 in 34; Liverpool Hospital (1,092 cases), 1 in 99. In some of the large hospitals the mortality is very great—Maison d' Accouches, Paris, 1 in 13½ cases; in St. Petersburg Hospital, 1 per 26½ cases. In the well-known Royal Maternity of London the deaths amount to (in 18,751 cases) 1 in 329 cases.

The Statistics of the Rotundo Hospital show at some times a high death-rate, at other periods a low one. The opinion of those well qualified to deduce inferences from these statistics is, that the low mortality always prevailed during the masterships of men who paid especial attention to the sanitary condition of the institution and of its occupants. If this view be correct hospitals might be so constructed and managed as to almost equal in salubrity a well kept private dwelling. Amongst the numerous defenders of the large hospital system when properly managed, I may specially name Mr. Simon, Medical Officer of the English Privy Council, and whose eminence as a sound sanitarian has never been questioned. Should even a large section of the medical profession pronounce against the continued existence of large hospitals, it is not probable, hardly possible, that these institutions will be replaced by cottage infirmaries for many a generation to come. We must, therefore, address ourselves to the improvement of the sanitary conditions of

¹ Dublin Journal of Medical Science, August, 1869.

existing hospitals and to the construction of those hereafter to be erected on the most approved principles which the combined wisdom of the sanitarian and architect can suggest. Let us attempt the consideration of some of these principles. Density of population being in itself a (complex) cause of disease, patients should be separated from each other by as wide a space as possible. The interval between the beds should not be less than 10 feet, and the minimum space per patient should be 1,600 cubical feet. When greater square and cubical space can be afforded, so much the better. According to Dr. Acland, the minimum square space per bed is 72 feet. In typhus and small-pox it is difficult to keep the air free from offensive odour even when the cubical space is extremely large and the ventilating apertures numerous. Some authorities state that in typhus, small-pox, gangrene, erysipelas, &c., from 3,000 to 6,000 cubical feet are necessary, and that even complete exposure to the air in suitable weather is even more desirable. From 3,000 to 6,000 cubical feet are not unfrequently introduced per hour per head into the fever wards of London and Continental hospitals without the bad odour present in them being wholly removed.

Dr. Brockley (*Economical and Medical Observations from the year 1758 to 1763 inclusive, London, 1764*) tells us that in small hospitals, which he had extemporized, sick soldiers generally recovered, whilst those placed in the ordinary hospitals suffered from a frightful mortality. The extempore hospitals were mere wooden sheds cheaply and expeditiously constructed, and much exposed to cold and moisture.

It is by no means easy to introduce large volumes of air into a ward without occasioning a disagreeable draught; but it is important to bear in mind that this task is easier in proportion as the cubical space of the room is increased. In very large hospitals the pure air, sufficiently warmed when necessary, may be propelled by machinery into the ward. This method is expensive and is not likely to be often adopted, neither is the converse plan of extracting (pumping-out) the air by means of machinery, whereby fresh air is caused to flow into the room. Extraction and propulsion of air are admirable plans for ventilating theatres, concert halls, &c., where large numbers of persons are temporarily congregated and are provided with very limited square space. In several Continental and American hospitals, Van Hecke's method of ventilation is in use in some wards. It consists of a fan worked by a steam engine, which drives air into small chambers in the basement story, where it is heated by stoves, and from which it ascends through tubes into the rooms to be heated and ventilated. In the Utica Asylum, New York, the fan is worked by a 2-horse power engine, and it blows air into a chamber where it is heated by 80,000 feet of steam piping: thus warmed it ascends to the wards, through their floors, and finally passes out of them through openings in the ceiling. This plan of heating and warming is said to be most effective and

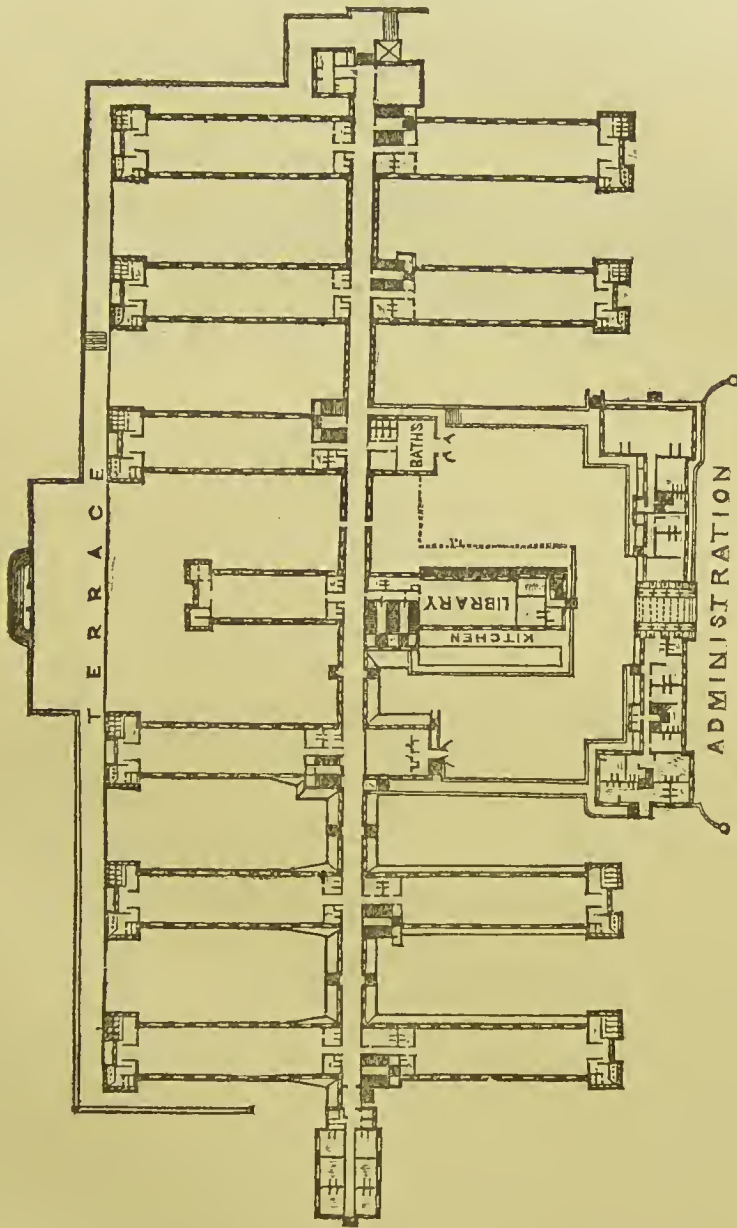
not too costly ; it is, however, only a modification of Silvester's plan of ventilating and warming rooms suggested many years ago. There should, besides the doors, windows, and open fireplace, be two openings each of 30 or 40 square inches for each patient. That for permitting the vitiated air to pass out should be directly over the head of the patient and at the highest point of the room. The inlet should be placed on or near the floor, if the air is to be warmed ; if not, at a height of 8 feet from the floor and directed upwards. The incoming air may be heated by passing it through small chambers provided with lead tubes containing steam or hot water. Abundance of warm air flowing into the ward under the bed of each patient, and flowing out high above his head, is the perfection of ventilation and heating. As in hot weather the air should not be heated, it would be desirable to have provisions for ventilating wards both in cold and hot weather. The inlets used on cold days might be closed during warm ones, and the floor ventilators brought into use. The outlets might, however, be the same on both occasions. The ends of the inlet tubes next the room should spread out like the mouth of a trumpet. They should be covered with coarse wire gauze, and they should be frequently examined, and cleaned as often as necessary. Wire or muslin gauze over ventilators serves to keep out smoke and dust. It is important that the air consumed by each patient should reach him directly and without passing over the beds of other patients ; arrangements should therefore be made to supply pure, and carry off foul air, close to each patient. In some wards the air for several persons is introduced through but one opening, and a portion of it passes over or close to several beds before it reaches the patient it is intended for. Although it is desirable for obvious reasons to have only one row of beds in the ward, yet we must at present tolerate two rows. In surgical and other wards where isolation of patients is generally desirable, why not separate the beds by glass partitions, 7 or 8 feet high ? They would not cost much. If the patients did not desire to look at each other the glass could be muffled in a minute with a little whiting and water. If such a plan were adopted, the air would ascend from each bed and pass out at the ceiling without commingling, or at least with much less commingling, with the general atmosphere of the ward ; but I fear it is useless to suggest such alterations in the structure of our hospitals, and no doubt they would be considered too costly and not called for.

For the future it is most desirable that hospitals should not be raised higher than one story besides the basement ; for they could be much more easily ventilated than the existing two and three storied buildings. In the excellent article on hospitals in the report of the Massachusetts Board of Health for 1874, the construction of one storied hospitals is strongly recommended. "The cost of construction would be very much less than in the many storied palaces ; but the cost of administration would cer-

tainly be greater. Whether these would be counterbalanced by the cheapness of the original outlay for buildings, we are unable to say—probably they would not. But this is not a mere question of cost, nor one of ordinary economy, but of economy of life, and it cannot be put aside with the usual argument of thrift." In ventilating a two or three storied hospital there is always danger that the foul air from the lowest story may enter those above it. Although there may be great difficulty in constructing large one-storied hospitals in cities such as Dublin, there ought to be none in the case of rural hospitals—those attached to country work-houses.

Miss Nightingale, in her admirable work on hospitals, insists on the importance of constructing those buildings in detached blocks, or pavilions, placed side by side, but separated by spaces equal to twice the height of each block. The buildings to consist preferably of a single story, resting upon an arched and ventilated, but uninhabited, basement. Each pavilion to be thoroughly ventilated and lighted, and to be provided with baths, water-closets, sculleries, &c., unconnected with the other pavilions. An airy corridor to give egress to the patients, and admission from the buildings devoted to the administration. The Herbert Hospital at Woolwich is constructed upon the block system. It consists of seven pavilions—four double and three single—raised on basements (the latter are used as store-rooms, museum, &c.), each having two floors. Each ward contains 30 beds in two rows, and includes about 40,000 cubic feet. At the end of each ward a large window affords an excellent prospect of the surrounding district, and of the beautiful gardens surrounding the hospital. There is one window for two beds, and the block is placed a little to the north of east, and has windows on each side. The sun's rays penetrate to the interior during nearly the whole of its course. The provisions, medicine, clothes, bedding, and fuel are conveyed along a corridor in the basement, and elevated by lifts to the wards. There are open terraces on the corridor for the patients to promenade in fine weather, and a covered corridor for use during rain or excessive cold. The bath-rooms and water-closets are situated at the end of each block, furthest removed from the great central corridor, and well surrounded by air. The wards are each warmed by fuel consumed in two open fire-places, with descending flues; and as the latter pass through chambers communicating with the outer atmosphere, the air introduced into the wards at these places is warmed. The floors are of oak, resting on iron beams, filled in with concrete. The offices, &c., of the administration are contained in a block, placed in the front of the hospital. Hot and cold water circulates in pipes throughout the building. The plan of the Herbert Hospital here given is taken from Miss Nightingale's invaluable work on hospitals—a volume which, together with Captain Galton's book and Mr. Robertson's pamphlets upon the same subject, have, to a great extent, been the means of

improving the sanitary condition of the hospitals and other large institutions of these countries. From Miss Nightingale's book I also copy the plan of a Convalescent Hospital.



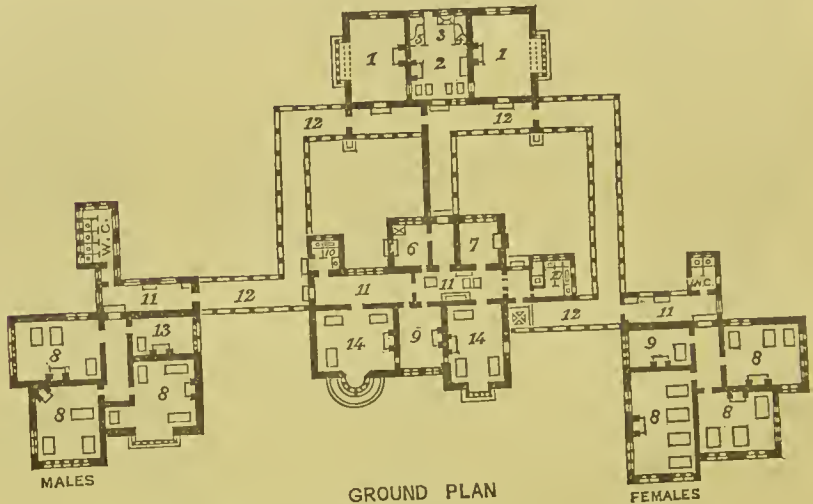
The wall surface of hospital wards should consist of enamelled tiles, of a pleasing colour. Tiles, however, are dear, though there might be easily manufactured for the purpose of lining walls a cheap salt glazed kind, of the nature of common crockeryware. It is of importance that the wall surface should admit of being occa-

sionally washed with soap and water—this cannot be done if they are whitewashed or coloured in distemper, as is generally the case. As little furniture as possible should be kept in the ward; and clothes and bedding should be the only absorbent materials tolerated. Venetian blinds placed outside the window, but controlled from within, are better than the ordinary linen blinds. Iron bed-

CONVALESCENT HOSPITAL.



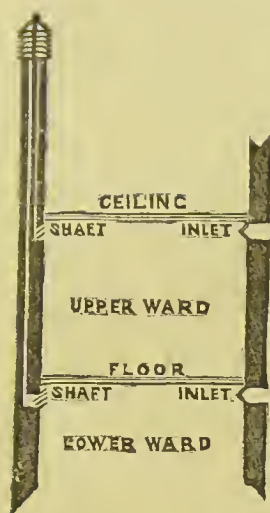
PRINCIPAL ELEVATIONS



GROUND PLAN

1. Dining and day rooms; 2. Kitchen; 3. Scullery; 4. Larder; 5. Store; 6. Dispensary; 7. Maid Servants' room; S. Convalescents' bedrooms; 9. Sisters or nurses'; 10. Baths; 11. Corridor; 12. Covered way; 13. Gardener; 14. Sick wards.

steads should be used, and the beds may consist of hair mattresses or straw, preferably the former. The water-closets and sculleries should be in buildings attached to (but outside of the walls of) the ward. The ventilating shaft, with which the tubes leading from the water-closets and scullery should always be provided, ought to ascend to a point as high as the chimney pots, and be provided at its outlet with a loose charcoal plug to absorb foul gases. Every hospital should have a spare ward or wards, so as from time to time each ward could be thoroughly cleansed; for it is not desirable to expose patients to the damp atmosphere of a recently washed room.



Section of Wards with Shaft Ventilation.

Miss Nightingale strongly recommends the ventilation of wards by means of shafts built into the walls, the openings into which to be close to the ceiling, as shown in the engraving. If, however, great care be not taken in the construction of the valved openings into the shafts, the air from the lower ward might be introduced into the upper ward.

Separate hospitals for different classes of diseases are much to be desired, and in small towns and rural districts the patients should at least be distributed in the wards according to their maladies. Under no circumstances should persons suffering from contagious and non-contagious diseases be placed in the same ward, or, if

at all possible, in the same building.

One of the oldest hospitals in Europe is that of St. Thomas, London. It has in some shape existed since the year 1207, and at present holds a charter from King Edward the Sixth. It has recently been rebuilt on a new site—that of the Albert Embankment, on the Lambeth side of the Thames—at a cost of about £400,000, exclusive of £90,000 for the $8\frac{1}{2}$ acres of ground on which it stands. The hospital consists of eight distinct three-storied buildings, having the same frontage towards the river, and connected by a corridor of 900 feet in length. A space of 125 feet separates each part of the buildings; but the central one is distant 200 feet from those on each side of it. The pavilions are placed at right angles to the corridor. Corridors run the whole length of the hospital on the ground and one-pair stories, and connect the several blocks of wards or pavilions. These corridors are lighted by large windows on both sides; and should it ever be deemed necessary to isolate any particular block, that could be done by placing screens across the corridors, and removing the sashes from the adjacent windows. The flat roof over one of the corridors of the first story is used as a means of communication between the various blocks on the two-pair story. The wards are 120 feet in length, 28 feet in width, and 15 feet in height, 28 beds, and afford 1,800 cubic feet of space for each patient. The beds are placed at distances of 8 feet from centre to centre, and the windows (through which the patient when recumbent can look out) are arranged alternately with the beds. Small wards for two beds, contiguous to, but not communicating with, the general wards, are provided in each block for the reception of patients. Adjoining the passage are placed the sisters' and medical officers' consultation rooms, and the ward kitchen. The staircases have steps $12\frac{1}{2}$ inches deep, with a rise of $5\frac{7}{8}$ inches. The water-closets, lavatories, and

bath-rooms attached to each ward are projected from the main building, and are cut off from the ward by intercepting lobbies, provided with windows on each side. The foul linen and dust shoots communicate with a receiving room in the basement. The nurses and servants sleep each in an attic, which is so situated that no air from the wards can reach them.

Each pavilion consists of three tiers of wards, together with four smaller wards on the ground floor for the reception of accident cases, &c. The wards have flat ceilings, and the windows extend from nearly floor to ceiling. From the corridors on ground floor patients are conveyed by lifts to the various wards: these corridors afford a place of exercise for the patients in wet weather, and the covered colonnades adjoining the river constitute a lounge for those able to walk. There are about 600 beds.

All the pavilions are alike, except the southernmost, which is designed for special diseases, inadmissible to the general wards. The male and female wards in this pavilion are separated by a central staircase. The wards on the ground story correspond in general arrangement, but in consequence of the main corridor on ground story being placed next the internal courts, the wards are shortened so as to admit of the construction of necessary rooms in connection therewith.

The general entrance to the hospital, which is placed in the centre of the series of buildings, is approached from the Palace New Road. The steward's or superintendent's offices are placed immediately in front of the entrance hall, so that everything passing in and out of the hospital is under his immediate supervision. From each side of the spacious entrance hall main corridors lead to all the departments of the institution. The ground floor of the first pavilion to the left comprises kitchen, scullery, and cooks' rooms, larder, bread room, &c. From this place the food of the patients is conveyed along passages, and raised by small lifts. The ground floor of the first pavilion to the right comprises the matron's department and linen stores. The principal staircase leads to the corridor on the one-pair story and communicates with the medical officers' apartments. The dispensary and surgery are in the main corridor, and over the laboratory, drug, and store-rooms.

The administrative offices comprise the governor's hall, committee rooms, almoner's room, counting-house, receiver's room, strong room, waiting rooms, offices for the clerk and surveyor of the hospital, the treasurer's residence, porters' rooms, houses for resident officers, training institution for nurses, &c.; there are also a chapel, a medical school, laboratory, museum, &c.

The ventilation of the ward is not of a very artificial kind. There is a main shaft for extracting the vitiated air carried up in the well-hole of the staircases; in it is placed the wrought iron smoke flue from the boiler, and in the upper part of the shaft are placed a hot water cistern and water coils. Shafts are car-

ried from the ends of all the wards, both at the ceiling and floor level; and from the centre a stove shaft communicates with a horizontal trunk in the roof, which trunk is connected with the heated shaft above mentioned. To replace the air thus extracted, fresh air is introduced through zinc tubes laid between the "Den-nett" arching and the floor boards communicating with the stoves and hot water coils, warmed in winter by contact with the heated surfaces. Each pavilion is independently warmed and ventilated. A chamber is formed under the ceilings of the corridor in the basement and ground floor, and into this the air from the rooms in the low intermediate buildings (out-patients' and casualty wards) is passed, and from thence is discharged into the main extraction shaft. The wards are warmed by open fire-places, aided in cold weather by an auxiliary system of hot water. The corridors and staircases are warmed by hot water pipes. The open fire-places are in the middle of the wards and have vertical chimneys; this helps ventilation, and increases wall space for beds. The ventilation of the water closets and lavatories is independent of the wards.

I shall conclude this chapter by quoting from the evidently well considered remarks of Mr. Simon on hospitals, in his Sixth Annual Report to the Privy Council, the following passage :—

That which makes the healthiest house makes likewise the healthiest hospital; the same fastidious and universal cleanliness, the same never ceasing vigilance against the thousand forms in which dirt may disguise itself in air, in soil, and water, in walls and floors and ceilings, in dress and bedding and furniture, in pots and pans and pails, in sinks and drains and dust-bins—it is but the same principle of management, but with immeasurably greater vigilance and skill; for the establishment which has to be kept in such exquisite perfection of cleanliness is an establishment which never rests from fouling itself; nor are there any products of its foulness, not even the least odorous of such products, which ought not to be regarded as poisons. Above all, this applies to the fouling of the air within hospital wards by exhalations from the persons of the sick. In such exhalations are embodied the most terrible powers of disease—the spreading flames, as it were, of some infections, and the explosive fuel of others; and any air in which they are let accumulate soon becomes a very atmosphere of death. Against this danger, ventilation is the one possible safeguard—ventilation which, with continuous current, shall always be bearing away, as rapidly as evolved, every volatile taint which rises from the sick. So that, for hospital hygiene, ventilation requires pre-eminent regard. And if ever the phrase "well ventilated" may be (though it never ought to be) at all indulgently construed in respect of a common dwelling house, it must never, in respect of a hospital, be construed but with the utmost conceivable strictness.

CHAPTER XIX.

SCHOOL HYGIENE.

No inconsiderable proportion of the life of the inhabitants of civilized countries is expended in schools and colleges ; the hygienic condition of these places, and the physical culture of the bodies of those who spend their time in them, are matters of great importance to the community. A large number of educational institutions exist on very unhealthy sites ; and in too many of them there is a serious deficiency in the arrangements for ventilation. They are also frequently supplied with water of bad quality, and in numerous instances their sewerage system is out of order. I have lately inspected the sanitary condition of several public schools, and in each I found the most serious hygienic defects. The case of Mercer's endowed school for girls at Ashtown, in the County of Dublin, will serve as an illustration. In this institution, which is situated in the open country, the girls were extremely well fed and comfortably clothed ; they were provided with ample play-ground, and they slept in well-ventilated dormitories. Notwithstanding these advantages their health was not nearly so good as that of the inmates of another school under the same management, who were not supplied with equally good food, and who lived in one of the most densely populated parts of the city of Dublin. On examining the state of Mercer's school, I found quite sufficient to account for the delicacy of some of its inmates. The main sewer was choked, and an untrapped opening in the bath allowed the sewage gases to enter in to the bath room, and from thence to diffuse themselves throughout the house. The well water, too, was impregnated with sewage, which escaped from the blocked-up sewer. It contained 56·56 grains of solid matter per imperial gallon (70,000 grains weight), of which 22·6 grains consisted of organic and volatile matters. There were large quantities of free ammonia, albuminoid nitrogen, nitrous acid, and nitric acid in it. In this case the school authorities (one of whom is the Most Rev. Dr. Trench, Archbishop of Dublin, and who for nearly three hours was present at one of my examinations) did their duty in making a thorough investigation into the cause of the unhealthiness of the institution ; but I fear that in but too many instances those in whom the management of scholastic and eleemosynary institutions is vested never think of ascertaining whether or not their sanitary condition is satisfactory.

The recent removal of the London Charter House, and others of the large endowed schools, from towns to suburban or rural districts is literally a move in the right direction, which we hope

will ere long become general.¹ Could there be a more unhealthy site, for example, than that of the Dublin Marine School, situated as it is on the banks of a river into which the sewage of a city of a quarter of a million inhabitants is discharged, and supplied with air contaminated with the exhalations of chemical, ammonia, coke, tar, gas, and artificial manure works? Children are less able to resist the effects of excess of cold or heat, and of deficiency of food, than adults; they also are more seriously affected by an impure atmosphere. A young man may endure without permanent injury a few years' exposure to insanitary influences; but if the period between infancy and adolescence be passed under conditions unfavourable to the vigorous development of the body, then, indeed, it is rarely that the child attains to a strong and healthy manhood.

The malign influence which schools exercise on the health of children attracted attention many years ago. Carmichael, in his work on scrofula, published in 1810, proved that the excessive amount of phthisis which he found in many of the Dublin schools was caused by defective ventilation, and not by insufficient nutrition. In the children's department of the House of Industry, the cases of scrofula were so numerous that the disease was believed to be present in a contagious form. In one of the wards, 60 feet long by 18 feet broad, there were no fewer than 38 beds, each containing four children! The amount of square feet allowed to each child was, therefore, only $6\frac{3}{4}$. The height of the ward is not given in Carmichael's work; but assuming it to have been 15 feet, that would have given to each child 102 cubic feet.

Neil Arnott and other authorities have placed on record cases of defective ventilation in schools almost as bad as those discovered by Carmichael; and if a careful inquiry were instituted at the present time, I have no doubt but that, even in the matter of ventilation, a large proportion of our schools would be found in a bad condition. The amount of carbonic acid gas in pure air is 0.04 per cent. When this proportion is doubled the state of the atmosphere is unsatisfactory. Roseoe found in the air of a school-room containing 22,141 cubic feet, and in which 164 boys were studying for two and a half hours, 0.2371 per cent. of carbonic acid; and in another school-room he found 0.31 per cent. of this gas. Da Luna found in a room of a girls' school, at Madrid, 0.723 per cent. of carbonic acid, or eighteen times the normal proportion of that gas. In two schools in Dublin I found the carbonic acid to amount to 0.14 and 0.12 per cent. respectively; but in others the air was tolerably pure. Dr. Endemann found the amount of carbonic acid in the air of 17 schools to vary from .097 to .357 per cent. I conceive that it is a part of the duty of the Medical Officer of Health

¹ The *Lancet*, in one of its reports on the condition of the English public schools, has shown the depressing influence on the health of the boys of London schools which the air of a large town exercises.—*Lancet*, May 14, 1870.

to inspect the schools, public and private, in his district, and to ascertain whether or not they are so over-crowded as to be injurious to health.

Physical exercise is now a feature of school and college life, and more especially so in these countries. A friendly emulation amongst the scholars of the same educational institution, and between rival schools and universities, in the performance of rowing, cricket, and other robust games, does much for the improvement of the physique of the rising generation. And it is in favour of these competitions that they have not a brutalizing tendency, like some of the pastimes of our forefathers. The drawback to the system of competition in athletic exercises is the undue strain which it so often imposes upon the muscular system, and which sometimes occasions permanent injuries, and even fatal lesions. Cricket is, perhaps, the game which is most unlikely to do violence to the important muscles; whilst it has the advantage of being, at least, a semi-intellectual pastime.

During inclement weather children should be provided with a large empty room as a substitute for the out-of-door play-ground.

With respect to the ordinary gymnastics in boys' schools, they are, on the whole, well contrived to produce a healthy development of the muscles. In France this kind of physical education has been brought to a high degree of perfection—thanks to the teachings and efforts of A. Thierry, Berard, Colonel Amoros, Beclard, Bouvier, Londe, and Milne-Edwards.

That veteran sanitarian, Mr. Edwin Chadwick, C.B., has, in a recent communication to the *Journal of the Society of Arts*, pointed out the more common defects of the ordinary schools of these countries. He maintains that the chief sanitary defects of our schools are—1. Defective ventilation; 2. Defective warming; 3. Bad drainage and foul latrines; 4. Want of means of maintaining personal cleanliness; 5. Bad lighting; 6. Bad arrangements of desks and seats; 7. Want of proper means of gymnastic exercises; 8. Insufficient and ill-paved play-grounds. He submits that it is important that school boards should require, in the competition for plans, that these evils should be first considered and provided for, and that the architectural designs and elevations be made of secondary consideration.

It is painful, he says, to observe the condition of children in the common schools in winter time, going there in cold and wet, in driving sleet and snow, frequently ill-shod, and commonly ill-clothed; kept in the school during excessively long hours under any conditions for children, with feet and hands painfully cold, fingers often so benumbed as to be scarcely able to hold their slates and pencils; the open fires at one end of the school not freely to be approached, and, when approached, the warming or heating on one side, "roasting in front and freezing behind," so as to give inflammations or colds from the disturbed and unequal circulation. The confinement of children for five or six hours under such conditions,

overtasked mentally, and painfully constrained bodily, surely requires active intervention for their relief. In every school-room there should be a thermometer, and the teacher should take care that it does not register less than 60 degs. Fahr.

Mr. Chadwick considers that of the modes of warming, those by hot-water pipes and iron surfaces are of inferior, and sometimes, when for high heats, of pernicious effect; besides, they are very expensive. They are apt to warm only the sides of the rooms, or the upper parts of them, and to leave the feet cold, unless an inconvenient and objectionable degree of heat is created over the whole room. It is, moreover, matter of considerable experience that warming by earthenware substances, or stone substances, especially by heat diffused over wide earthenware or concrete surfaces, is more agreeable and more salubrious than any warming by iron surfaces.

In Germany attention has been called to the poisoning of the air of school-rooms by carbonic acid and carbonic oxide passing into it through the sides of iron stoves. Dr. Oidtmann, in a pamphlet on this subject, published in 1868, states that chronic poisoning of children by carbonic oxide is very common. I agree, then, with Mr. Chadwick in considering the principle of floor-warming, which he has so long advocated, as the best. In some of the public schools, too, such a plan would prevent the tyranny of the larger boys excluding the weaker and more delicate children from snug places beside the stove or fire-place.

In the large institutions, where children are boarded, the effects of progressive sanitary improvement have been distinctly marked. In one, where the death-rate had been about twelve per thousand, the foul air from cesspools and bad drains was excluded, the latrines were mended, and the ventilation was improved, whereupon the death-rate was reduced to eight in a thousand. Next, regular tepid ab'ution, and, in summer time, cold water bathing and careful skin-cleanliness was introduced, and the death-rate was reduced to four in a thousand.

Mr. Chadwick advocates the washing of children at schools, for various reasons, hygienic and otherwise. There is, in well-appointed schools in Holland, usually a female attendant on the schoolmistress, who takes the dirtied children into an apartment and washes them, the schoolmistress herself being above such a service.

There are, no doubt, few (if any) private schools now in existence on the type of Dotheboy's Hall; but in cheap boarding schools there is no guarantee that the children located in them receive a sufficient quantity of nutritious food and at proper times. I have known many cases where parents were obliged to remove their children from boarding-schools, even of the better class, because of their insufficient dietaries. Notwithstanding the advantages resulting from free trade, the State should take care that competition in boarding-schools does not result in the pupils being insufficiently fed as well as badly instructed. Every school should be managed,

as in Prussia, by a person licensed for such a purpose, and should be subject to official visitation.

The celebrated Rudolph Virchow, Professor of Medicine in the University of Berlin, has written (in 1869) a valuable treatise¹ on the diseases incidental to schools, which I should be glad to see translated into English, and circulated amongst the school authorities of these countries. Virchow agrees with those orthopedists who maintain that the school is largely to blame for distortions of the spine, and more especially for that form of spinal curvature termed *Scoliosis*. He quotes several eminent authorities, amongst others Guillaume, who found amongst 731 scholars whom he examined no fewer than 218 with distortion. The great majority of cases of scoliosis are amongst girls. In 72 cases noticed by Knorr, of Munich, there were 60 females. As girls spend less time at school than boys, and fewer girls attend at school, it has been urged that scoliosis is not most frequently induced by bad postures whilst studying. To this objection it may be answered that boys during their hours of play counteract by vigorous exercises, involving the play of nearly all the muscles of the body, the evil influence of the school-room postures. On the other hand, girls, as a rule, do not practise any kind of gymnastics.

In almost every school the children in each class, no matter their heights, have to sit at desks of the same size: why could not the desks for each class be made in short lengths, and of different heights, so that no child would be placed at one either too low or too high for him or her?

Dr. Guillaume gives a table showing the proper height of desks for children of different heights.

Height of pupil.				Height of table.	Height of stool.	Height of back.
ft.	in.		ft in. ²	in.	in.	in.
3	0	to	3 3	13.5	7.5	9.8
3	3	„	3 6	14.7	8.5	10.8
3	6	„	3 9	15.8	9.5	11.9
3	9	„	4 2	17.0	10.3	12.9
4	2	„	4 5	18.1	11.2	14.
4	5	„	4 8	19.2	12.2	15.
4	8	„	5 1	20.4	13.1	16.1
5	1	„	5 4	21.6	14.1	17.2

Virchow attributes a large proportion of the pulmonary consumption of childhood to over-crowding in school-rooms, to sudden changes of temperature in passing from hot school-rooms into the cold outside air, to the dust of the school-room, and, lastly, to impaired respiratory movement induced by prolonged sitting.

Short sight is the commonest disease in Germany. Dr. Cohn found that 60 per cent. of the students of the University of Breslau

¹ Ueber gewisse die gesundheit benachtheiligende einflüsse der schulen.

² 11 Swiss inches equal 13 English inches.

were near-sighted. He blames the school-room for a large proportion of this disease. The rooms are not properly lighted, which obliges the scholars to stoop over their books. This causes a strain upon the muscles of the eye, producing an increase of hydrostatic pressure on the posterior portion of the eye-ball, and a lengthening of the axis of the eye. This state of tension, if prolonged, produces a permanent elongation of the axis of the eye. Besides, the stooping position determines an increased flow of blood to the eye-ball, and thereby augments the pressure on the back part of the eye. Leibreich states that short-sightedness is developed, with rare exceptions, exclusively during attendance at schools. Virchow gives a list of various other diseases which originate in, or are aggravated by, the insanitary condition of school-rooms.

The *Lancet* for March 30th, 1872, called attention to the deplorable condition of the children in pauper schools. At Mitcham, Islington, Anerly, and other schools of the same class, there were from 10 to 15 per cent. of the children suffering from ophthalmia. The government inspectors attributed the ophthalmia to constitutional defects, but the *Lancet* very properly remarks, why is it that the very same classes of children "running about naked and shoeless in the streets escape?" The cause of the ophthalmia is unquestionably due to over-crowding and impure air.

All our schools should be as regularly inspected by public officers as workshops and factories are. There are many laws on our statute books which relate to the health of men, women, and children employed in mines, factories, and other places: why should there not be equal provision for ensuring the health of the millions of children at school in these countries? Amongst her Majesty's Inspectors of Schools there ought to be a few Medical Inspectors. Let us not forget the old adage, *mens sana in corpore sano*.

CHAPTER XX.

SEWAGE AND SEWERS¹.

The removal and disposal of the effete matters produced in dwellings, factories, stables, &c., is one of the most perplexing problems which the sanitarian is expected to solve. On two points in relation to this matter there is unanimous agreement of opinion—namely, the necessity for the speedy and complete removal of

* The Acts of Parliament relating to sewers, privies, waterclosets, and earth-closets are:—11 and 12 Vic., c. 63; 14 and 15 Vic., c. 28; 18 and 19 Vic., c. 121; 24 and 25 Vic., c. 61; 26 and 27 Vic., c. 40; 27 and 28 Vic., c. 114; 28 and 29 Vic., c. 75; 29 and 30 Vic., c. 90; 31 and 34 Vic., c. 115.

sewage from towns, and the desirability of turning it, if possible, to useful account, by applying it, partially or wholly, to the soil. But with respect to the methods for accomplishing these objects, the greatest diversity of opinion prevails amongst engineers, chemists, sanitary reformers, and agriculturists. Some recommend that the egesta of the population should not be passed into sewers at all, but that it should be retained, commingled with clay, charecoal, &c., and sent in a solid form into the country, to be there used as manure. Another plan is the separation of house sewage from drainage, and the manufacture of the former into a manure. The ordinary sewage is proposed, by many patented processes, to be treated with chemicals, for the purpose of disinfecting it, and precipitating from it manurial matters. Some recommend the simple application of ordinary sewage to meadows. Others consider that the fertilizing value of the article is so trifling that it would be better to pour it at once into the ocean.

Scores of books, pamphlets, and papers have been written to prove the great agricultural value of town sewage; and we have the highest authorities in favour of the use of this liquid for the purpose of fertilizing the soil. There is no doubt but that in the long run the agricultural and civic interests involved in the question of sewage will be found to coincide; but the onus of taking the first step towards the solution of this problem rests on the authorities of the towns. That agriculture sustains a loss, so long as the sewage of towns is poured into the ocean, is quite true; but that loss is a mere negative evil, whilst the presence of this baneful stuff in the midst of a crowded city is a positive injury to its inhabitants. Are the citizens to tolerate the existence of an evil amongst them which annually sends no inconsiderable proportion of them to the grave, simply because those to whom that evil would prove a benefit exhibit no anxiety to take advantage of it? To the farmer the aspect of the sewage question is simply a pecuniary one, and were he never to be supplied with the commodity, he would not, as a rule, be the worse off; but to the citizen, the removal of the sewage is a matter of life or death. I venture to assert that if all the towns in Ireland were thoroughly sewered, and the contents of these sewers prevented from flowing into open rivers, the Registrar-General would have fewer deaths to record in his mortuary tables. Many of the diseases which prove fatal are the results of breathing air and drinking water rendered impure by sewage.

Since the subject of the waste of the excrementitious matters produced in towns began to attract public attention many persons have suggested the complete separation of the liquid and the solid excrements of man from the fluid which converts them into sewage. All the attempts, and they have been many and costly, to separate the valuable ingredients of sewage from the water in which they are in so excessively diluted a condition have hitherto failed, though some plans now on trial afford some promise of a certain

amount of success. Nearly 90 per cent. of the solid matter dissolved in the sewage cannot be precipitated from it by other than processes so costly as to totally preclude their economic application. But, then, it may be urged, why mix at all the animal fertilizers produced in the city with so prodigious a volume of water? why deprive agriculture of so useful and so portable a manure? I answer:—To the citizen, sanitary considerations are primary considerations; it is impossible to remove excrementitious matter from our houses unless by mixing it with abundance of water. I am therefore opposed to the plan so constantly suggested to treat our liquid and solid egesta after the manner of the Chinese. In the Celestial Empire, as travellers tell us, altars to Cloacina—at which visitors as well as the inmates may worship—form conspicuous objects in the dwellings of the inhabitants; and certain natural operations which in the rural parts of these countries are frequently performed beneath the shelter of a friendly hedge are in the “flowery land” conducted on the roadside, and with appliances provided by the nearest farmer. Something like this system of manure preservation is to be found in Belgium; but I believe it will never prevail in these countries, where it is so much opposed to all our notions of sentiment and decency, the tendency of which is to keep such matters as much as possible in the background. It would be far better that every particle of fertilizing matter produced in the city should continue to be discharged into the thankless ocean rather than, in the great towns at least, we should revert to the old system of privies and cesspools. It has been suggested that water-closets, communicating with sewers, should be completely done away with, and that the excrements, liquid and solid, should be received into close vessels, containing earth or some other deodorizing substance. In this way, it is contended that the valuable manure produced in cities might be rendered innocuous and portable. Leaving out of the question such considerations as the enormous quantity of earth which would be required to supply the wants of the 25,000 houses constituting Dublin, it may fairly be doubted that such a plan would pay its own expenses. In the city of Manchester the system of cesspools still largely prevails. The Corporation discharge the duty of emptying these cesspools, at a cost to the city of more than £20,000 per annum. Of this large sum about one-half is recoverable by the sale of the manure; but still a large deficit remains. I believe, then, that if Irish Corporations undertook to remove the contents of the privies and cesspools that still remain in their towns, they would find their operations in that line anything but profitable. There is no doubt but that the present mode of getting rid of the waste matters produced in Dublin is incomparably superior to the old plan of cesspools; and any one who takes the trouble of studying this question will see that in every city in England in which there is no system of sewers the rate of mortality is very high. Since the

abandonment of the cesspool system in London the public health in that city has wonderfully improved.

The citizens of Dublin have incurred very heavy pecuniary liabilities in their desire to procure a plentiful supply of pure water, and I have no doubt but that their health is benefited by that display of liberality. But I firmly believe that the question of good sewerage is of equal importance to any that has arisen with respect to the relative qualities of the Vartry water and that furnished by the canals, and to me it is quite clear that the sanitary state of Dublin must continue defective until every house in it communicates with a great central drain, and the waters of the Liffey pass undefiled through the city.

The fertilizing value of sewage has failed to satisfy the expectations of some people who had previously entertained a high opinion of its efficacy. On the other hand, many who doubted its utility have lately seen good reason to change their opinions. The sewage of the old part of the city of Edinburgh has for a long time been employed for irrigating meadows; and the grass farm of Mr. Miller, at Craightinny, has for many years been held up as an example of the wonderful fertilizing power of sewage. This farm consists of 250 acres of land reclaimed from the sea, and which, at one time, was let at 4s. or 5s. an acre. Over this farm the sewage derived from a district inhabited by 80,000 souls is poured: nothing save grass is grown; and the amount of produce which it is stated is annually obtained is almost incredible—three or four, and even five, heavy crops have been obtained in one year, and that, too, in a rigorous northern climate. The Craightinny meadows are let to dairymen of Edinburgh at an average rent of £22 per acre. With respect to the disposal of its sewage, Edinburgh is far more favourably situated than any other large city in the empire; its site being much higher than the surface of the surrounding country, the mere force of gravity conduces its sewage to the meadows which it irrigates. Formerly about 2,000 acres were irrigated by the Edinburgh sewage; but the spread of buildings, and other causes, have reduced that number by more than one-half.

At Rugby, town sewage has been applied to agricultural purposes for some years past; and Mr. Walker, a gentleman in the neighbourhood, receives the whole amount of sewage produced in the town, for which he pays a rent of £50 per annum. In 1861 a Royal Commission was appointed to experiment on the sewage of Rugby. The object was to determine the quantity and composition of grass produced on land, a portion of which was to be manured with sewage, and another portion to remain unmanured. Fifteen acres were divided into three equal parts—one for grass on which cows were to be fed, another for grass on which oxen were to be fed, and the third was to be meadowed. Each of these five acre divisions was further sub-divided into four plots, one of which was left unmanured, and the others received respectively

different quantities of sewage. Some of the results obtained are tabulated in the following table:—

PRODUCE GIVEN TO OXEN.

Plot	Sewage required per annum.	Actually applied to end of October.	Total grass per acre.				Increase of grass per 1,000 tons of sewage.			
			tons.	cwt.	qrs.	lbs.	tons.	cwt.	qrs.	lbs.
1	—	—	9	5	3	5	—	—	—	—
2	3,000	1,872	14	16	3	8	2	19	1	7
3	6,000	4,423	27	1	0	10	4	0	1	9
4	9,000	6,153	32	16	3	8	3	16	2	9

On the grass given to the milch cows the effects of the sewage were still more favourable, as will be seen in the following table:—

PRODUCE GIVEN TO MILCH COWS.

Sewage applied.	Number of weeks the produce kept a cow.	Gallons of milk per acre.	Value of milk at 8d. per gallon.	Value of milk from increased produce of 1,000 tons sewage.
0	19	321	£ s. d. 10 14 3	£ s. d. 5 0 0
1,387	40·9	570·7	19 0 6	5 19 10
2,804	58·8	820·4	27 6 11	5 16 8
4,226	68·9	961·3	32 0 10	5 0 11

In these trials it is shown that the application of sewage was attended by a very great increase in the produce of grass. "Deducting the value of the milk from the grass of the unsewaged from that of each of the sewaged acres, reckoning it at 8d. per gallon, it appears that where about 1,400 tons of sewage were applied, during the seven months, the produce calculated for each 1,000 tons of sewage actually applied gave an increased amount of milk to the value of £5 19s. 10d.; where twice that amount of sewage was applied, £5 16s. 8d., and where three times the quantity, £5 0s. 11d." The value of the milk obtained from an acre of unsewaged grass was only £10 14s. 3d., whilst from the most highly sewaged grass the value of the milk amounted to no less than £32 0s. 10d. The Rugby experiments, which were conducted under the direction

of Mr. J. B. Lawes—so well known for his invaluable chemico-agricultural investigations—have been considered somewhat unsatisfactory, on the ground that the sewage was not always applied at the proper time; and Mr. Walker states that the fields were flooded to such an extent as to seriously deteriorate the quality of the herbage. Mr. Lawes admits that the experiments were in some respects so conducted that their results would not appear so favourable to the sewage as under proper conditions would have been the case; but still the great fact remains that land abundantly sewaged is capable of producing three times as much milk as the same kind of land when unsewaged.

The sewage of Ashburton, in Devonshire, is distributed over the greater part of a valley which lies close to the town; the sewaged portion of the valley lets at the rate of £6 per acre, whilst the rent commanded by the unsewaged fields is only £1 per acre. The sewage of Mansfield is poured over lands in the vicinity of the town, which, in consequence, have, it is stated, been raised in value from 3s. per acre to £12 per acre. A large part of the sewage of Carlisle is used for irrigation purposes. It is mixed with a little carbolic acid and lime, which, it is stated, renders the sewage inodorous. About 4,000 tons per acre are used, and farm crops obtained. At Croydon the sewage has for many years past been distributed over about 260 acres of land. Excellent crops are grown and no bad odour complained of by the nearest inhabitants. Some years ago the sewage of this town was discharged into the river Wardle, the water of which, in consequence, became so impure that persons lower down the river could make no use of it, for domestic or other purposes. Under those circumstances, some parties who possessed an interest in the water power afforded by the river instituted proceedings against the Corporation of Croydon, with the view of compelling them to allow the river to pass unpolluted through the town. The corporation were defeated; and, after numerous unsuccessful attempts to deodorize the sewage, they were at last obliged to lease about 300 acres of land, for the purpose of pouring the sewage over it, and getting rid of it in that way. They subsequently let the land thus irrigated at a rent of £300 per annum, greater than that paid for it by themselves; but owing to the law suits and to the attempts to deodorize the sewage by removing, in a solid state, its fertilizing matters, this practical solution of the sewage question, unfortunately, cost the people of Croydon no less than £40,000 for an income of £300 per annum. In one respect, however, and that a most important one, this mode of disposing of their sewage has been productive of the happiest consequences; for it is stated that the annual death-rate in their town and the adjacent districts immediately after sensibly declined. Here, then, we have the best evidence—that afforded by accurate statistics—to show that the thorough and speedy removal of the sewage of a town promotes, in a remarkable manner, the longevity of its inhabitants. The

latest accounts of the Croydon sewaged farm show that it is becoming more profitable, and perhaps it may ultimately realize sufficient to pay for the original cost of establishing it.

The sewage of the small town of Worthing, formerly discharged into the Ira, is now poured over 100 acres of land. The soil is good, the crops excellent, and, above all, the farm is profitable. Dr. Buchanan states¹ that the Worthing Irrigation Works were the most perfect he had ever seen. The Earl of Essex applies a large portion of the sewage of Leamington to his farm, and apparently with decided advantage. In 1873 I inspected this sewage farm, and did not perceive the slightest bad odour. The weather was, however, at the time rather cool. At Bedford, Warwick, Romford, Cheltenham, and many other towns, the sewage is used for irrigating purposes, and in general with decided success.

On the Continent the sewage of towns is in some places utilized on a large scale. Some time ago our government appointed a commission, composed of Messrs. Way, Austin, and Southwood Smith, to draw up a report on the system of irrigation followed in the north of Italy. In this report it is stated that the sewage of the city of Milan is employed in irrigating about 4,000 acres of land situated at a distance of a few miles from the city. Each acre receives annually about 9,000 tons of sewage in which are contained the ejestæ of forty persons. This land possesses an extraordinary degree of fertility, and becomes so charged with rich organic matter that its surface is periodically pared, and the pairings used to manure other lands not so favourably circumstanced. A Doctor Chiappa has a farm of 580 acres near Milan, which is manured with the sewage of the city. The portion devoted to grass contains 80 acres, yielding annually 22 tons of produce per acre. The grass is partly made into hay, partly consumed in the green state, and is found sufficient to maintain 100 cows. It is calculated that the 9,000 tons of sewage applied to each acre are equivalent to £4 8s. worth of well decomposed manure; but it must be observed that the sewage of Milan is commingled with the water of the river Vettabia, and is consequently more dilute than the sewage of Dublin. The conclusions at which these commissioners arrived were chiefly as follows:—That the experience of the application of sewage in the neighbourhood of Milan affords a striking illustration of the immense advantage which the command of large quantities of mere water alone confers upon agriculture; that the fertilizing virtues of the water are enormously increased by the addition of sewage, and by its temperature being raised by its passage through a town; that the health of the population of the districts manured with sewage is not worse than that of the population of regions in which pure water irrigation is carried on; that notwithstanding the elevated temperature of Italy, no disagreeably odorous emanations arise from the sewaged fields; and, finally, the commissioners condemn in very decided terms the folly

¹ Ninth Report of Medical Officer of the Privy Council, p. 196.

and extravagance of the British people, who, by most expensive arrangements, seek to get rid of a manure which ought to be equivalent to the annual exportation of many hundred thousand tons of guano.

With respect to the application of sewage derived from manufactories, public institutions, and other large establishments and villages, there is abundant evidence to show that the general results have been satisfactory. Alderman Meechi states that the use of sewage on his celebrated farm at Tiptree Hall proved highly productive and remunerative. The Earl of Essex has constantly employed sewage manure since, I believe, 1857, and with an extraordinary degree of success. This nobleman states that he has obtained from sewaged meadows the large produce of 46 tons per acre, whilst from the same quality of meadow, which had not been sewaged, the produce amounted only to from 7 to 8 tons. On the Earl of Essex's farm an application of 270 tons sewage per acre of mangels produced a yield of 43 tons, or about double the average produced of that crop in England. Latterly the earl has somewhat restricted the application of the sewage to grass lands. In the case of market gardens the use of sewage has proved profitable. In the number of the *Irish Farmers' Gazette* for 27th Aug., 1859, Mr. R. O. Pringle gives an interesting account of the results of the application of sewage at Mr. Niven's celebrated garden farm, Drumcondra, Co. Dublin:—"The system of liquid manure which has been adopted at this farm is very simple. At the upper end of the field there is a large tank, which is kept full of liquid manure of the best description, derived from the High Park Reformatory. Before Mr. Niven got this portion of the ground all the sewage from that establishment was discharged into an open ditch, and was, in fact, a great nuisance, as well as likely to prove prejudicial to the health of the inmates. By an arrangement with the managers of the institution, Mr. Niven was permitted to throw pipes across the old ditch and convey the sewage into his own tank; and some idea of its value will be gathered from the fact that the consumption of soap alone in the reformatory is nearly a ton a week, producing an immense quantity of suds, which, with other materials, combine to form a most valuable manure." At the time of Mr. Pringle's visit there was a fine crop of kemp potatoes which had been manured with sewage only, and which, up to the 11th August, had furnished $11\frac{1}{2}$ tons per acre, a considerable quantity still remaining in the ground. When we consider that market gardens require the largest supplies of manure, and that those in the neighbourhood of London sometimes receive 120 tons of natural manure per acre, I think the case of the garden farm at Drumcondra indisputably proves that sewage is capable of supplying the wants of every kind of crop.

With respect to the kinds of crops to which sewage is most adapted, it appears to be admitted on all sides that the natural and artificial grasses are those that have hitherto been most benefited

by its application. There are, however, on record the results of experiments which go far to prove that sewage may, under certain circumstances, be usefully applied on tillage farms. As a general rule, the constituents of a manure are rendered more efficacious by dissolution in large quantities of water, because they are certain to be thereby equably distributed throughout the soil, and each of the plants they are intended to nourish will obtain its fair share.

The advantages of using manure in the form of a dilute solution are clearly shown in Mr. Ruston's paper in the 20th volume of the *Journal of the Royal Agricultural Society of England*. This gentleman obtained a large increase in all his crops—grass, green, and white—by simply applying the manure for each acre commingled with about 4,000 lb. weight of water. As a general rule, however, I believe that town sewage, which is an excessively dilute solution of manure, cannot be employed to any great extent on tillage farms, more especially on those that are not thoroughly drained.

Light or medium soils resting on a sandy subsoil will be found the best absorbents of sewage, although their power of retaining the fertilizing ingredients is not so great as that of heavy clays. On stiff clay lands, the chief fault of which is their impertransible nature, large dressings of town sewage would not be beneficial—nay, would be the reverse; the fluid would rest on the surface, and render the soil so cold and wet as to be decidedly injurious to most plants. Land of any kind under cereals cannot constantly be the scene of sewage irrigation, for during the long period of the year devoted to the preparation of the ground a dry and easily pulverulent condition of the staple is desirable, and during the ripening of the crop, heat and a very moderate degree of humidity are necessary. It is clear, then, that cereal crops could only be benefited by very moderate doses of sewage applied at only certain periods of the year. Still, where sewage is available, I believe that both white and green crops would be largely served by its use; and if it were in a more concentrated condition than that derived from large towns is, it might be applied during by far the greater part of the year. The use of dilute sewage on a tillage farm being, therefore, very restricted, it would be unwise to attempt to supply the tillage farmers of a wide area with the drainage of a city like Dublin. Gas companies often find it unprofitable to lay down pipes to certain districts remote from their works, although their commodity is sold at the rate of 4s. or 5s. per thousand cubic feet. It would be still more unwise for sewage utilization companies to attempt the laying down of pipes over a wide district in order to supply an article at the rate of only 1d. or 1½d. per ton. Grass lands are in a very different condition with respect to sewage: they are ready at almost any time for the reception of that manure; and their produce is, within certain limits, proportionate to the amount of sewage applied.

With respect to the proper quantities of sewage to apply to

grass, considerable difference of opinion prevails. Very different estimates have been made relative to the actual quantities which annually flow over the Craigentenny meadows. Mr. James Hope sets it down at 2,000 tons per acre; Mr. Miller states it to be 4,000 tons; the late Mr. Austin, C.E., estimated it at 8,000 tons; whilst Professor Anderson considers it to amount to 14,000 tons. As these meadows receive the sewage of a district inhabited by 80,000 persons, Dr. Anderson's estimate is probably the nearest to fact. It is quite certain that the Edinburgh meadows receive enormous quantities of sewage which do not appear to have exercised any injurious effect upon the nature of the grasses grown thereon, except in rendering them exceedingly succulent. This disproves the statement made by certain writers, that large doses of sewage render the herbage of meadows very coarse and inferior. No doubt, in the case of retentive soils continued floodings of either sewage or pure water would render the herbage coarse; but where provision is made for the moderately rapid passage of the liquid throughout, and from, the soil very large quantities of sewage will not injuriously affect the herbage grown upon it. Several authorities upon this subject contend that moderate dressings of sewage—from 2,000 to 5,000 tons per acre per annum—give in the end better results than excessive applications; whilst Mr. Lawes states, in his evidence before the select committee on the sewage of towns, that if he got it for nothing he would apply 70,000 tons of sewage to an acre, or, he adds, "anything you like to give me." Mr. Westwood, late farm bailiff to the schools at Annerley, stated before the committee that he obtained as large a return from two acres of rye-grass, to which 1,500 tons of sewage had been applied per annum, as from two other acres which had been manured with between 8,000 and 9,000 tons. As this witness had been obliged to furnish accurate returns relative to the farm under his management to the Government Inspector, the select committee appear to have attached great weight to his evidence. It appears to me that the pouring of 20,000 to 30,000 tons of sewage over an acre of grass is a useless expenditure of the greater part of the fertilizing matters contained therein; and I have no doubt but that the Craigentenny meadows would yield as good crops as they do at present were their present supply of sewage curtailed by three-fourths of the amount. The evidence given in the report of the select committee on the sewage of towns is certainly, on the whole, in favour of light dressings as against heavy floodings.

In relation to the chemical composition and commercial value of sewage, the greatest variety of opinion prevails, especially with respect to the latter point; some place so low a value as a $\frac{1}{2}$ d. per ton upon the article, whilst others estimate its money value at from 1d. to 9d. per ton. Sir Charles Fox believes it to be worth $1\frac{1}{2}$ d. per ton; Dr. Hoffman sets it down at 2d.; Mr. Lawes says that if obliged to take it at all times he would not give $\frac{1}{2}$ d. per ton.

It is very difficult to arrive at an accurate knowledge of the composition of the sewage of a large city, owing to the many disturbing influences which affect it. The rainfall, the supply of water in each locality, the food of the inhabitants of the district, and the hour at which the article is collected, are all important points which must be taken into consideration in estimating the average value of a ton of sewage.

In a paper which I read before the Royal Dublin Society in 1865 I calculated from analytical data that 100 tons of sewage of Dublin contained the following fertilizing ingredients:—

1ST. IN COMPLETE SOLUTION—

Nitrogen	16.50 lb.	at	£70	per ton	£0 10 3.75
Phosphoric Acid	3.85	„	40	„	0 1 4.50
Salts of Potash	5.12	„	20	„	0 0 10.97
Salts of Soda	16.63	„	1	„	0 0 1.78
Total	...	...	...	...	£0 12 9.00

2ND. MECHANICALLY SUSPENDED—

Nitrogen	2.48 lb.	at	£70	per ton	£0 1 6.60
Insoluble Phosphate of Lime	1.84	„	8	„	0 0 1.57
Organic Matter	14.00	„	0 10s.	„	0 0 0.75
Total	...	...	...	...	£0 1 8.92
Grand Total	...	...	...	...	£0 14 5.92

As Dublin since 1865 has been supplied with a purer and more abundant source of water, its sewage now contains less solid matters.

With respect to the amount of sewage annually produced in Dublin, I made the following calculations:—The present supply of pipe water is about 9,500,000 gallons per day; the average daily rainfall over the sewer districts is about 5,700,000 gallons. The amount of sewage, therefore, which passes daily into the sewers is 15,200,000 gallons, or 67,857 tons 2 cwt. 3 qrs. 12 lbs., which, at the rate of 14s. 5.92d. per 100 tons, would have a money value of £481 14s. 9½d. From these data it will be found that the sewage annually produced in Dublin amounts to 24,767,857 tons 3 cwt. 2 qrs. 12 lbs., the money value of which is £179,484 7s. 4.8d. Of course, the values placed upon the ingredients of manures are those which they would really possess if they were parts of concentrated manures; but in sewage their actual value, owing to excessive dilution, is much less than if they entered into the composition of guano. If 100 tons of this sewage were gradually distributed over an acre of land, under any kind of crop, I believe it would be good value for 14s.; but, under ordinary circumstances, so large a quantity of sewage is applied per

acre that a large proportion of its soluble ingredients passes away from the soil.

The greater part of the most valuable ingredient of the sewage—namely, its nitrogen—is in the form of urea. This substance, I proved by experiments, performed in 1856 (and described in a paper read before the British Association at their meeting in 1857), to be capable of directly furnishing nitrogen to plants; but Liebig has since then shown that it passes readily out of the soil—a negative quality which is a great drawback to its use as a manure. The soil possesses the remarkable property of removing from their solutions such substances as potash and phosphoric acid, which furnish food to plants. When sewage water is poured over the lands, the soil seizes upon and retains the ammonia and phosphoric acid present in it, but allows the urea to pass through. This curious absorptive power of soils has, however, its limits, so that if an excessive quantity of sewage be poured over a field, a large portion of it, and more especially its urea, will not be permanently retained by the soil. Owing to these circumstances, and to the fact that the sewage flows at times that it is not required, the actual value of the drainage of a city will not correspond with the theoretical estimate which I have given. If, however, the sewage of Dublin be applied to an area of 8,000 acres of grass land, its money value will be found to be not much short of £80,000 a year.

The value of the sewage of a town may be ascertained by other means than the analysis of the article. By determining the actual value of the egesta of an average unit of the population of a town, and by ascertaining the number of its inhabitants, a pretty close estimate of the value of its sewage (provided, of course, that all the waste matters pass into drains) may be formed. There are, however, considerable differences of opinion as to the manurial value of the excrements of an individual, averaging all ages and both sexes. Dr. Hoffman and Mr. Witt estimate them at 10s. 10d. per annum, while Professor Anderson sets them down at 6s.

With respect to the purification of the river and bay, which would result from the application of the sewage of a city like Dublin, I need but remark that the insoluble ingredients in the latter amount annually to about 5,000 tons of absolutely dry matter, corresponding to at least 40,000 tons of fetid mud, which at present, like waifs and strays, is tossed to and fro by the tide, discharging fever-breeding gases and vapours into the air.

Since the subject of utilizing the sewage of towns has become a popular one, the question has arisen, will the application of sewage on a large scale injuriously affect the health of the people who may happen to live near the sewaged lands? In the case of a portion of the sewaged meadows near Edinburgh there is no doubt but that gases, vapours, and putrescent particles are occasionally given off, which are extremely unpleasant to the sense of smell, and certainly are injurious to health. At Lochend and

Roseburn the odour, especially during very warm weather, is sometimes offensive; and the winds that constantly blow from either of these places into the city are anything but "balmy breezes." These malarious exhalations arise, however, to a great extent from the open drains through which the sewage flows. A large proportion of the effete matter produced in the "old town" passes into a stream termed very characteristically the "Foulburn." This stream becomes an open sewer just beyond the eastern side of the town, and during the summer constantly evolves highly fetid gases and vapours. At Craigentenny, which is about two miles from the city, the sewage is poured over grass land which speedily drinks it up and completely deodorizes it. I have on three occasions during warm weather visited the sewaged meadows at Craigentenny, and I am enabled to affirm from actual observation that the odour from them is almost inappreciable.

Dr. Alfred Carpenter states the public health of the Croydon districts has been improved since the establishment of the sewage farm. Dr. Buchanan expresses his belief that sewerage works never injuriously affect a population, but, on the contrary, improve it. Of course, if sewaged meadows be not provided with proper drains, they will become marshes and develop malaria. Dr. Cresswell says, that at one time the sewage farm at Norwood was badly managed, and, becoming marsh-like, caused some intermittent fever amongst the children of the locality; but since that time the fields have been properly managed, and no disease of any kind has been attributed to exhalations from them, though a school is situated close to them. There is a public footpath through the meadows near Croydon, which I have traversed on a very warm day without being conscious, so far as my sense of smell was concerned, that I was surrounded by hundreds of acres of sewaged land. I believe that an odour is occasionally observed, but it is very slight.

A strong complaint was made in 1864 with reference to the supposed injury inflicted on the public health by the sewage works and irrigation at Northampton. Dr. Hunter, Inspector of the Medical Department of the Privy Council, investigated into the complaint, and found it baseless.¹ He, however, ascertained that the injury to public health complained of was due to some works from which noxious gases were evolved.

The *Lancet* Sanitary Commission states,² relative to the two farms at Croydon, "The result of our careful inquiries into the sanitary conditions prevalent in the neighbourhood of the two farms has convinced us that they have produced no perceptible ill effects on the health of the inhabitants."

Dr. Cobbold, in a pamphlet published in 1865, expressed a strong apprehension that the use of sewaged grasses would give

¹ Report of Medical Officer, Privy Council, 1864, page 526 *et seq.*

² The *Lancet*, November 4, 1874.

rise to serious entozoic disease ; but there is not the slightest evidence to prove that internal parasitic diseases are more frequent in the case of persons who have, since their birth, been consuming, indirectly, the produce of the Edinburgh sewage meadows. Sir Robert Christison avers that he was never able to trace a single case of parasitic disease to the swaged meadows of Edinburgh.

The best way to dispose of the sewage of a town or village is, first, to precipitate any substances that can be cheaply got out of solution ; secondly, to pass it, after defecation, over a sufficient area of soil.

The most valuable manure ingredient of recent sewage is urica, for which there is at present no precipitant known. All that can be thrown down from sewage is the insoluble matters mechanically suspended in it, its phosphates, and a portion of its ammonia. The A B C process, which consisted of adding alum, blood, and clay to sewage, has failed. The addition of calcium, magnesium, zinc, iron, and manganese salts has proved inefficacious.

Dr. Emerson Reynolds and myself have examined Dr. Anderson's patent process for the treatment of town sewage, and the preparation from it of an inodorous manure. In order to fully acquaint ourselves with the several operations, we visited the works of the General Sewage and Manure Company at Nuneaton, in Warwickshire, and have since experimented on a considerable scale with the sewage of Dublin. The process, as modified in accordance with our suggestions, essentially consists in the precipitation of the substances mechanically suspended in sewage, and of certain matters dissolved therein, by means of slaked lime, and a cheaply prepared sulphate of aluminium.

The sewage is pumped or allowed to flow into large tanks. Solution of sulphate of aluminium is added to it, and the liquids are thoroughly mixed by means of an "agitator." Slaked lime is next and quickly added and diffused through the liquid.

The proportions of the precipitants used per 100,000 gallons of the sewage are 4 cwts. of crude sulphate of aluminium and 2 cwts. of slaked lime. The crude sulphate of aluminium is not directly added to the sewage ; the soluble portion is extracted by water, and the solution is employed for precipitation in conjunction with the lime.

In from three to five hours after treatment the sewage separates into two parts—one liquid and the other solid. The liquid is nearly devoid of odour when fresh sewage is operated upon, and is almost as bright and transparent as ordinary water. It still, however, retains in solution certain bodies—urea, for example—from which it can be purified by simple percolation through clay. The clear liquid is run off from the containing tanks, but the solid sediment is left behind ; this when collected on rough strainers and dried in a kiln constitutes a useful manure.

The crude sulphate of aluminium used in the above-named process is very simply prepared by the action of common oil of

vitriol on a kind of clay found abundantly in England, in the neighbourhood of Dublin, and in many parts of Ireland.

The sewage manure obtained is a dry, inodorous powder, containing from 1 to $1\frac{1}{2}$ per cent. of nitrogen, partly as ammonia, and from $1\frac{1}{2}$ to $2\frac{1}{2}$ per cent. of earthy phosphates. The precipitate afforded by the average sewage of Dublin—a liquid remarkably poor in ammonia-yielding compounds—contained in 100 parts:—

Moisture	...	...	...	...	6.76
Organic and volatile matters	...	...	...	...	18.50
Phosphoric acid, equivalent to tricalcic phosphate	...	...	...	...	1.90
Alkaline salts	...	...	...	...	2.16
Alumina, ferric oxide, and earthy salts (chiefly chalk)	...	...	...	...	67.76
Insoluble matter	...	...	...	...	2.92
					<hr/>
					100.00

Yielding ammonia, 1.12.

The money value of this manure, calculated in the usual way, is £1 9s. per ton.

I have carefully inquired into the cost of production of this manure, and estimate it at ten shillings per ton. As the material could be sold wholesale at over £1 per ton, its sale would realize a good profit, and the manure would be sufficiently valuable to bear carriage to distances of from 10 to 30 miles from the point of manufacture.

The quantity of sewage is so enormous in a large town that, notwithstanding the small amount of manurial matter contained in a ton, a very large produce of the useful and portable fertilizer above described may be calculated upon.

When Dr. Anderson's treatment is carried out in the way suggested, the deodorising effect on fresh town sewage of the ordinary character is very great. The subsidence of the solid matter carrying with it a little saline ammonia is speedy, and the precipitation of the valuable phosphoric acid and nitrogenized organic compounds almost complete. As urea is a body rich in nitrogen, the effluent water obtained by the Anderson process is capable of most advantageous use for irrigating land, since percolation of the fluid through the soil serves to render the nitrogen of the urea available for plant nutrition.

After defecation the sewage should be filtered through beds of clay used to irrigate fields. An acre of moderately stiff soil will purify from 2,000 to 3,000 gallons of sewage daily; and therefore a farm of about 70 or 80 acres would suffice to filter the sewage of a town of 10,000 inhabitants. In summer, when the crops are growing rapidly, the solid matters will be more speedily

used up than in winter. When soil is used as an ordinary filter, about 1,000 cubic yards would be required per 100,000 gallons of sewage.

The sewage of prisons, hospitals, workhouses, factories, &c., should be defecated and filtered through clay, or applied to meadows before being discharged into rivers or drains. When at all possible, the drains for discharging rain water should be separate from those that convey the house sewage, in order that there may be a smaller quantity of liquid to defecate. The sewage should be discharged into a covered tank, containing a deodorizing compound. For 1,000 gallons of ordinary house sewage, any one of the following mixtures may be used:—(1) Quick lime, 3 lbs.; carbolic acid, half a pint. (2) Crude sulphate of aluminium, 2 lbs.; chloride of calcium, 3 lbs. (3) Ferric chloride (perchloride of iron), $\frac{1}{2}$ lb. (4) Chloralum, 3 lbs.; quick lime, 2 lbs. (5) M'Dougall's powder (a mixture of "bisulphate of lime" and "carbolate of lime"), $\frac{1}{2}$ lb.; quick lime, 2 lbs. These are about the proportions to be employed, but some sewages would require smaller, others perhaps larger, amounts. An impure chloride of iron could readily be prepared by treating the "bog iron oxide" so abundantly found in many parts of Ireland with commercial muriatic acid. This preparation may be regarded as one of the best deodorants for sewage, and it does not interfere with the subsequent agricultural applications of the manure. Another good sewage deodorant could be cheaply prepared by dissolving dolomite (magnesian limestone) in common muriatic acid—the products would be the chlorides of calcium and magnesium.

The sewage, after treatment with some of the above mentioned deodorizing mixtures, should be daily discharged into the meadows, or run into the filter beds. It will hardly be worth while to make a portable manure out of the sewage of a single building, such as a workhouse; but when such a process is to be conducted with the sewage of a town, Anderson's plan will be found the cheapest and best. For mere deodorization, lime and carbolic acid will be found the cheapest agents.

Earth Closets.—The Rev. Mr. Moule has strongly recommended the use of dried earth as a receiver and deodorant of night soil, and he has devised a "dry closet," to be used instead of the ordinary water-closet. It consists of a kind of commode, containing a receptacle in which a layer of dried earth is placed. After use a handle is pulled up, by which a small but measured quantity of earth is let loose from a store, and spread over the excreta. The merit claimed for this plan is that the excrementitious matter is instantly covered up by one of the best deodorants—clay—commingled with which it can be removed from the house (without making any odour), and used as a valuable manure. On each occasion upon which the closet is used about $1\frac{1}{2}$ lbs. of clay are used. The mixture of excreta and earth is inodorous, and re-

mains so for months, the former in the meantime slowly oxidizing into carbonic acid, water, ammonia, nitrates, &c. Stiff clay, loams, and peaty soils are the best to use with the closet. The advantages claimed for this system are, that the commode can be placed at the bed side of patients in sick rooms and hospital wards, who though not well able to go to the water-closet, still are not sufficiently disabled to be obliged to use a bed-pan; that it prevents noxious or unpleasant odours; and that it prevents the waste of valuable fertilizing matters. Various modifications of Moule's earth commode have been made. Some are so constructed that their contents may be discharged into a pipe which descends into a vault or chamber. Large reservoirs of earth may be placed in a position to feed a number of closets.

The carbon disinfecting and deodorizing closet of Weare & Co. resembles somewhat Moule's commode. It consists of a perforated earthen pan, placed beneath the seat, and above a moveable box containing a perforated iron bucket. The space surrounding the pan and bucket is filled with ashes and powdered wood charcoal. In the act of shutting the lid a small quantity of a disinfecting powder—carbolate of lime, &c.—is liberated from a box, and falls upon the excrements. This closet retains all the solid, and a portion of the liquid, excrements, and the excess of the liquid passes away by a drain.

Peat and other kinds of charcoal, dried, and fine turf mould, are excellent deodorants. Mr. Stanford, of Glasgow, makes a charcoal from seaweeds, uses it as a night soil deodorant, and when saturated with excreta distils the mixture in gas retorts. The products given off—ammonia, acetic acid, tar gas, &c.—together with the residual charcoal, would, Mr. Stanford believes, afford a good profit on the whole operation. According to Mr. Danchell, 3 ozs. of peat charcoal are equal in deodorizing power to $1\frac{1}{2}$ lbs. of clay, and 1s. 6d. worth of charcoal will be sufficient for the use of a family of six persons for one month. According to the Rev. Mr. Moule, each person who uses his closet requires only 2 cwt. of clay per year.

The dry closet system has come into partial use in these countries, and, perhaps, may be still further extended. In the villages of Beverly and Halton, near Tring, the earth-closet system was fully introduced in 1870. The earth is dried over a fire, and half a load of it distributed to each family three or four times a year. It is dried and used twice, after which it is conveyed to the fields to be used as a manure. Dr. Buchanan, in the Report of the Medical Officer of the Privy Council for 1869, gives a very favourable account of the use of the earth-closets at Wimbledon Camp, Dorset, and Lancaster Grammar Schools, Dorset Gaol, and Brodmoor Lunatic Asylum. In Indian Barracks and other buildings the success of the earth closet system is said to be very great; and the plan is likely to be very much extended in that country. Dr. Buchanan states that the primary cost of replacing the outside

privies of a town of 1,000 inhabitants by earth-closets within the houses need not exceed £250; nor need the weekly expenditure be more than £4 15s. In Lancaster, where the system is somewhat generally adopted, the sale of the earth and manure mixture has realized, it is stated, a sum equal to the cost of working the scheme. At Merthyr Tydvil the sewaged meadows (rye-grass) have been let at £30 an acre.

M. Baudin has patented a plan for separating liquid from solid excreta, which for some time past has been in use on the Great Eastern (England) Railway. The *Lancet* for February 8, 1873, thus describes it:—

The apparatus consists of a truncated cone of wire gauze, which is fixed, base downwards, in a cylinder of perforated metal. The cylinder is surrounded by, and nearly fills, a strong water-tight cylinder of galvanised iron, connected by a union joint with an air-tight cistern. The outer cylinder is about three feet high. The space between the cone and the inner cylinder is filled with some porous substance—with spent tan, in the experiment which we witnessed. This substance, whatever it may be, is saturated with some powerful antiseptic compound. The excreta, both solid and liquid, fall into the cone, the mouth of which is about six inches in diameter. Here the solids are retained, while the liquids filter through the tan, are disinfected in their passage, and finally pass into the outer cylinder, and thence to the tank. The cylinders must, of course, be changed by the company when full, and the tank emptied; but it is calculated that the apparatus is large enough to retain the whole excreta of one adult for twelve months, so that with a family of six it would only be necessary to change the cylinder every two months. When full, the cylinder with its contents, and the liquid in the tank, are to be removed to the company's works, the liquid boiled down, and mixed with the solids, tan and all, taken from the cylinder. The whole is then dried, pulverised, and sold as "human guano."

In the case of large towns difficulty would be experienced in procuring adequate supplies of dried earth for the use of Moule's closets. If London were furnished with dry, instead of water, closets (it has nearly a million of the latter), whole acres of soil would be weekly carted into the great metropolis. Another drawback to the use of dry closets is that they do not afford facilities for the disposal of liquid excrements and slops of all kinds.

Water-closets, in my opinion, are the best means of removing excreta from the houses of at least the better classes. They have their drawbacks, but so have all other systems for getting rid of human egesta. They should be supplied with abundance of water, not merely wherewith to remove the excreta, but also to flush the soil pipe and house drain. It is not wise, on the part of municipal pipe water authorities, to be chary in supplying the cleansing liquid to the water-closets. It is most desirable to have the water-closet placed outside the house; and if there are several, they should be placed one over the other. They should be thoroughly ventilated, and both the ingress and egress air openings should communicate with the outer atmosphere, and not with the house. M'Kinnell's and the Archimedian screw ventilators are well adapted for water-closets placed outside the house walls. The soil pipe

should be provided with a ventilating tube, taken from a point close to the pan, and carried up the height of the chimney. As air with difficulty ascends or descends through a single tube, it would be better to provide the soil pipe with two tubes, which would ensure its thorough ventilation. A small quantity of charcoal, to be renewed from time to time, may with advantage be placed at the external opening of the tube; for I have known several instances where the foul air from the ventilating tube of a water-closet found its way into the upper rooms of the house. This also shows the necessity of carrying up the pipes to a great height. The soil pipe should be made of stout lead, for the thin metal soon yields to the action of sewer gases. The bad odour sometimes observed in water-closets is occasionally due to the minute holes made through the soil pipes by the sewer gases. The space immediately below the pan often contains fetid matter, which had not been properly flushed out, and the gases evolved from it must rush into the closet when the handle is lifted. This part of the closet might also be advantageously ventilated, by means of a small tube passing from it into the soil pipe ventilator. The cistern for supplying water to the closet should be used for that purpose solely. Daily there might be thrown into it a small quantity of carbolic acid; and it should be cleaned out occasionally. I have often found water-closet and other cisterns full of filth and exhaling a bad odour. A sink should be provided on bedroom floors, so as to prevent the slops from being thrown into the water-closet, but the sink pipe should be trapped, ventilated, and occasionally flushed, just as in the case of a soil pipe. Miss Nightingale has strongly condemned the large stone sinks so generally used in the scullery. They are often a great nuisance, but they are convenient, and if properly cleaned, would produce no nuisance.

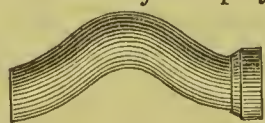
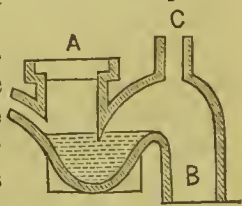
The overflow pipe from a cistern of water intended to be drank should never be permitted to communicate with the soil pipe or its ventilator. Cases of typhoid fever and of dysentery sometimes arise through neglect of this precaution. When the soil pipe ventilator enters the rain spout, the rain should only be allowed to flow into the latter through a valve opening, and the foul air from the soil pipe should be discharged upwards through a pipe placed at the top of the spout. The waste water from baths is generally discharged into the soil pipe—not a good plan in any case, but a very bad one when there is not a good trap to the waste water pipe. Urinals should be made of glazed porcelain, and the pipes leading from them should be trapped and ventilated.

House Drains made of stone or brick are apt to leak, and they should, therefore, consist of earthenware pipes perfectly cylindrical, fitting into each other and well cemented. They should be glazed inside and outside. Iron pipes are not so good as earthenware, but when used their interior surface should be glazed. It is a point of the greatest sanitary importance that the drain should be wholly outside the house, and that at the point where the different pipes (from water-

closets, baths, &c.) join it there should be effective water traps. The size of the drain depends on the quantity of sewage likely to be passed through it; but for most houses it need not be more than four inches in diameter. When a drain is carried through a house (as is generally the case in streets) it is better not to bury it beneath the flags of the basement, as is usually done, but to expose it fully to view. It is easy to perceive a bad odour from a drain, and to provide a prompt remedy for it when the pipe is visible; but too often the underground house drain leaks its noisome contents for months and years without the openings being detected. There are contrivances ("access pipes") for opening drains in order to clean them, but they are rarely used.¹ When drain pipes are laid in the ground, care must be taken that they rest upon a substantial foundation. They should be laid upon an incline and have a fall of 1 foot per 50 feet. The junctions of the pipes with the drain and the cementing together of the different parts of the latter are often imperfectly done; therefore, the sewer maker and plumber's work must be carefully looked after ere it is hidden. However conscientious the contractor may be in the performance of his undertaking, his operatives are often very careless in doing their part of the work.

Traps are the chief contrivances for preventing the entry of sewage gases into our dwellings, and they, therefore, merit some attention. The bell trap is one of the commonest in use, and undoubtedly the worst. It has several modifications, but a common form consists of an inverted cup dipping into water placed in a groove or space round the openings into the sewer. The lid attached to the inverted cup is perforated to allow the liquid to pass into the outer space and thence into the sewer. Nothing is more common than the removal of these traps by servants in order to let garbage, that will not go through the grating, fall into the open tube. Nor do they always promptly replace the trap, for frequently they leave it off for hours and days.

The syphon trap is a curved tube which is always full of liquid, and prevents the passage of the gases from the sewer housewards. The water in it should stand about one inch higher than the openings in the pipes. S-shaped syphons are usually employed in water-closets and



urinals. The syphon trap is strongly recommended by Mr. Eassie, author of "Healthy Houses," as embodying all the requirements of such a contrivance.

The pan of the closet, which is fitted into the socket A, is ventilated by a pipe which joins the ventilating pipe C, and goes up to the roof. A two-inch supply pipe from the cistern divides behind the closet-pan, and one moiety

¹ Doulton and Watts, Jennings, and others, have patented plans for this purpose.

enters the pan above the opening A, whilst the other enters the syphon-trap under the opening A, through the inclined channel. These two streams of water act simultaneously when the water-valve is raised, and scour out both the pan and the trap beneath down to the pipe B, into the drain. Apart from the value of this improved syphon as a closet-fitting, its use as a large ventilated sink or other trap must be obvious.

Cesspools are used with both the water-closets and the privy system. When in connection with the former, the sewers leading to them should be trapped and ventilated; the ventilating tubes being placed against a wall or tree, and run up as high as possible. The cesspools should be water-tight and not too large, so as to avoid the danger of storing very putrid matter. They should be covered over; and if from time to time some deodorizing matter be thrown into them, so much the better. The further cesspools are removed from dwellings the better. When the cesspool is attached to the privy and in connection with the ashpit, the coal ashes thrown into it serve to render the excreta less offensive. Yard traps are very frequently of ineffective construction, and they are seldom examined or cleaned. The medical officers of health or inspectors of nuisance should always sharply observe the condition of the traps when making their house visitations.

In many of the houses of even the richest in the land the condition of the sewers and cesspools is very bad. Unpleasant odours are constantly noticed, diarrhoea is sometimes almost endemic, and typhoid fever even appears, and yet no one suspects that the cause of the bad odours and the sickness is the escapement of foul gases from untrapped drains and overflowing cesspools. In January, 1872, at the request of Sir Charles Domvile, I inspected the sanitary arrangements of that palatial residence, Santry House, county of Dublin, and I ascertained the cause of the bad odours which for some time previously had almost rendered the house uninhabitable.

The following are the heads of the report which I made, and which will serve to show that attention to sanitary matters is as necessary in the palaces of the great as in the overcrowded dwellings of the poor :—

“1. The water-closet in the Vandyke wing is not provided with a ventilating tube. It should have one passing from the soil pipe immediately below the trap into the open, and carried up to the house-top. This tube should be provided with a hood, in order to prevent the wind from blowing down through it. This w. c. has a foul odour.

“2. W. C., front stairs. No odour was perceived on lifting the valve, but there is no ventilating tube from the soil pipe.

“3. Glass court. The drain running from barrel to main sewer requires to be trapped; at present it exhales a slightly fetid odour.

“4. In the passage leading from the glass court there is a large iron tank, the water in which is slightly stagnant. The overflow pipe from this tank descends apparently to the depth of about ten

feet, into what I am informed is a subterranean tank for storing water in. On lowering a candle to the bottom of the overflow pipe it was subjected to a strong current of air, which nearly put it out. This air contained sewage gases. It is evident that the subterranean tank has an overflow pipe, which passes into a sewer. It is clear, then, that the gases and vapours have a ready entrance into the house by means of the overflow pipe above mentioned. This pipe requires a valve, and the subterranean reservoir should be opened and its contents examined. It is likely to contain decaying animal matter, such as drowned rats. So long as this defect exists, so long will there be a stream of sewage gases into the basement story of the house. The upper part of the house is to some extent ventilated from the basement story of the house, which is most undesirable.

"5. The w. c. in bedroom corridor has a foul odour. The soil pipe delivers its contents into the rain spout, which passes into a cesspool. The spout should act as a ventilator, but probably there is a fecal accumulation in the soil pipe, which a good flushing would remove.

"6. Attic w. c. appears in good order.

"7. There is a cesspool under the laundry from which gases and vapours are allowed to pass into the atmosphere of the latter. The cesspool here should be done away with, as there is no way of cleansing it out.

"8. The tanks at the back of the stables and at the corner of the servants' hall, in the pleasure ground, should be provided with ventilating shafts. The housemaids' w. c. is untrapped.

"9. The w. c. close to the pump is a source of impurity to the latter.

"10. The cesspool next to the dairy should be done away with, as its contents are allowed to overflow into a main sewer. The cesspool should always form the terminal point of a sewage system. There are numerous useless ones at Santry House.

"11. The scullery sink is in a bad state, and requires to be trapped. In the kitchen passage there is a bad odour, which proceeds most likely from leakages in a cesspool beneath the passage floor. This defect requires attention, as there is no need for a cesspool there.

"12. Rose garden. I notice a pump quite close to a sewer into which rabbits have burrowed. The water of this pump can hardly be free from sewage contamination, yet it is often, I learn, used for potable purposes.

"13. The cesspool in the rose garden appear to be useless, for there is nothing to prevent the sewer which supplies it from being extended to the main drain. If it be not done away with, it should at least be ventilated, and the pipes carried to a good height."

Street urinals should be made of glazed iron, and a small stream of water should constantly trickle through them. The pipe carrying off the liquid should be provided with the syphon trap, and

the whole place should be flushed, cleansed, and deodorized frequently.

Street Sewers.—It is a matter of vital importance to the inhabitants of a town that the organic refuse produced in it be removed completely and expeditiously. Before the present century vast quantities of filth were allowed to accumulate in tanks or pits, termed *cesspools*; and whenever the amount of refuse exceeded certain limits, it was removed by manual and horse labour. The cesspools attached to the houses of the wealthy classes were of course, as a general rule, frequently emptied of their noisome contents, and their condition rendered as innocuous as possible; but it would appear that the majority of town cesspools were much neglected, many of them remaining uncleaned for several years. It can easily be imagined what a bad effect these accumulations of putrefying animal and vegetable matters must have produced upon the health of the inhabitants of towns. They poisoned the atmosphere with fœtid emanations, whilst the overflow or leakage of the liquid contents furnished abundant contributions to the wells. In the country, cesspools did not produce anything like the same effect, because they were situated at some distance from the house; but in the crowded cities their deadly vapours could only, in most cases, escape into the atmosphere of the people's dwellings.

About thirty-five years ago the cesspool system began to be superseded by the sewerage system. Each house was provided with a close drain, through which the refuse was discharged into a large street sewer, and by it conveyed to a river or the sea. At first the street sewers were so large that a man could pass through them; but their diameter was gradually reduced, until at length their ordinary size was from 12 to 30 inches. Large drains are found to retain, for a long time, much of the refuse discharged into them, and it is found very difficult to flush them properly.

There can be no question as to the great superiority of the sewerage system as against the cesspool plan; for in every town where it has been adopted the public health has been greatly improved. Mr. Simon, the medical officer of the Privy Council, in his annual report for the year 1866, gives a list of twenty-four English towns in which, owing to the adoption of the new sewerage system and the improvement of the water supplies, the death-rate has been diminished from 5 to 50 per cent. The sewerage system is, however, open to one great objection—it has converted a large number of rivers into mere sewers, and has greatly injured the riparian fisheries.

When the outfall of a sewer is a tidal river or the sea, its mouth is blocked up daily, sometimes for several hours at a time. The gases generated in the sewers become imprisoned, and often regurgitate into the houses, especially where the traps are not of the best kind, and where the house drains are unventilated. The gratings in the streets often permit the pent-up gases to escape, and to produce a dangerous nuisance. It is important that a sewer,

whenever practicable, should be allowed to freely discharge its contents. I know of several seaports into the streets of which, during high water, the sewer gases are poured forth through untrapped, or badly trapped openings, in vast quantities. These are the places where especially the town sewage should be received into tanks, defecated, and used as an irrigant.

Sewers discharging their contents into the sea, and having a good fall, should be carried out as far as possible, so as to thoroughly mix their contents with the salt water. When sewage is discharged into a river, the point of entry should at least be below, and not above, the town. Dr. Corfield mentions a case where the sewage of a town was discharged into a sewer at a place a mile above where the same river supplied water to the same town. The following directions in reference to sewerage, prepared by Mr. Rawlinson, C.B., have been issued from the English Local Government Board Office:—

Before a scheme of sewerage is devised, the district should be fully examined so as to obtain a correct idea of the drainage area, or the several drainage areas; enquiry should then be made to ascertain how surface water has passed off up to the time of such examination, and with what effects. Main sewers and drains should be adapted to the town area, length of streets, number of houses, surface area of house-yards and roofs, number of street gullies, and volume of water supply.

Sewers and drains, in wet subsoil, should be made to act as land drains.

The following rules are general. Each surveyor must, however, use his own judgment, and make the best arrangements possible, having regard to the circumstances of each special area and the materials at command.

1. Natural streams should not be arched over to form main sewers.
2. Valley lines and natural streams may be improved, so as to remove more readily surface water and extreme falls of rain.
3. Main sewers need not be of capacity to contain flood water of the area drained; such flood water may be passed over the surface, in most cases, without causing injury.
4. Main sewers should be laid out in straight lines and true gradients, from point to point, with side entrances, or with manholes and flushing and ventilating arrangements at each principal change of line and gradient. All manholes should be brought up to the surface of the road or street to allow of inspection, and should be finished with a cover easily removable.
5. Duplicate systems of sewers are not required. Drains to natural streams in valley lines for storm waters may be retained, and may be improved, or, if necessary, enlarged.
6. Earthenware pipes make good sewers and drains up to their capacity. Pipes must be truly laid and securely jointed. In ordinary ground they may be jointed with clay. In sandy ground special means must be used to prevent sand washing in at the joints. House drains should, in all cases, be laid in a water-tight trench. If the subsoil is porous, the trench should be lined with clay puddle. Special care should be taken to prevent any contamination of wells by sewage from main sewer or from house drain, the water from which wells is to be used for domestic purposes.
7. Brick sewers ought to be formed with bricks moulded to the radii.
8. Brick sewers should, in all cases, be set in "hydraulic mortar," or in cement. In no case should any sewer be formed with bricks set dry, to be subsequently grouted.

9. Main sewers may have flood-water overflows, wherever practicable, to prevent such sewers being choked during thunderstorms or heavy rains.
10. Sewers should not join at right angles. Tributary sewers should deliver sewage in the direction of the mainflow.
11. Sewers and drains, at junctions and curves, should have extra fall to compensate for friction.
12. Sewers of unequal sectional diameters should not join with level inverts, but the lesser or tributary sewer should have a fall into the main, at least equal to the difference in the sectional diameter.
13. Earthenware pipes of equal diameters should not be laid as branches or tributaries—that is, 9-inch leading into 9-inch, or 6-inch into 6-inch, but a lesser pipe should be joined on to the greater, as 12-inch to 15-inch, 9-inch to 12-inch, 6-inch to 9-inch, and so on.
14. House drains should not pass direct from sewers to the inside of houses, but all drains should end at an outside wall. House-drains, sink-pipes, and soil-pipes should have ample means of external ventilation.
15. Sinks and water-closets should be against external walls, so that the refuse water or soil may be discharged into a drain outside the main wall. Down spouts may be used for ventilation, care being taken that the head of such spout is not near a window. Water-closets fixed within houses, and having no means of direct daylight and external air ventilation, are liable to become nuisances, and may be injurious to health.
16. Inlets to all pipe drains should be properly protected.
17. Side junctions should be provided in all new sewers and drains. The position should be sketched, and indicated by figures in a book or on a plan. Side junctions not used at once should be carefully closed for subsequent use.
18. A record should be kept by the surveyor of the character of the subsoil opened out in each street as it is being sewered or drained.
19. Sewers and drains should be set out true in line and in gradient. All the material used should be sound, and the workmanship should be carefully attended to.
20. "Sight-rails" should be put up in each street before the ground is opened out, showing the centre line of each sewer and depth to the invert.
21. Sewers having steep gradients should have full means for ventilation at the highest points.
22. Tall chimneys may be used, with advantage, for sewer and drain ventilation, if the owners will allow a connection to be made.
23. Sewer outlet works should be simple in form, cheap in construction, and so arranged as to remove all solids, sediment, and flocculent matter from the sewage. Some drawings of works of this character will be found at the end of these minutes.

The ventilating shafts of main sewers are now occasionally provided with charcoal, which absorbs the fetid gases. Mr. Latham places the charcoal in a spiral tray, which ensures a thorough contact between it and the gases.

It is difficult to decide whether cesspool privies, earth-closets, or water-closets are best adapted for the dwellings of the lower classes. When they are supplied with the water-closet, it soon gets out of order, unless supervised by the health authorities. In most places the water-closet system amongst the poor has been more or less a failure; but in one, Liverpool, it has proved a

decided success and upon a very extensive scale, too. Dr. Trench, Medical Officer of Health, states that during an epidemic of typhoid fever in 1866 the only localities that seemed exempt from it were the places occupied by the poor in which all the privies had been replaced by water-closets. In towns where the domestic scavenging is undertaken by the health authorities—and *every* town should be so circumstanced—water-closets of a simple and inexpensive kind would undoubtedly be the best mode of getting rid of the excreta of the lower classes. In enforcing the cleansing of these places the Inspector of Nuisances will, however, have no easy task to fulfil.

An elaborate report well worth the perusal of the Medical Officer of Health, by Dr. Buehanan and Mr. Radcliffe, describes¹ the actual method of getting rid of excremental matters in various villages and towns in England and Scotland, and is illustrated with numerous engravings of water-closets, earth-closets, privies, middens, ashpits, sewage-tanks, and carts, vans, &c., for the removal of night soil and other refuse. The general conclusions at which they arrive are as follows:—

1. Excrement may be removed from a town and safely disposed of on more than one principle, and the same principle does not need to be applied in all quarters of the same town.

2. As regards the parts of a town inhabited by the poorer classes, a water-closet system may be managed so as to be entirely applicable to the circumstances of the most ignorant and most careless population. Essential conditions of such applicability, however, are that the structural arrangements should be adapted to their purpose and be independent of the person using the closet, and that the management should be wholly undertaken and efficiently done by the servants of the sanitary authority. Where these conditions are observed as thoroughly as they are observed in parts of Liverpool, we believe that water-closets are the best means of removing excremental matters from the poor neighbourhoods of a town.

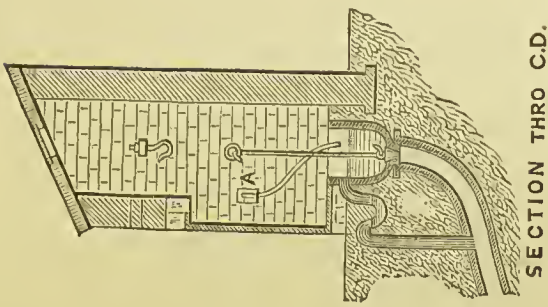
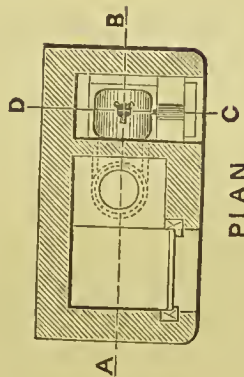
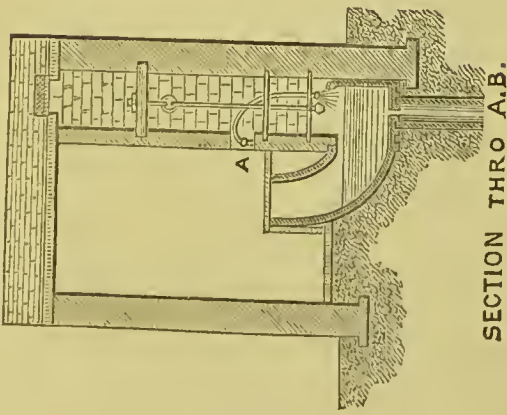
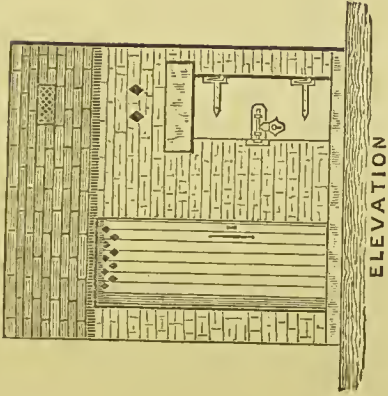
3. The earth system affords a second way of safely disposing of excrement. It is, as shown in the special report on earth-closets, an essential element in this system also, as applied in poor neighbourhoods, that the entire management of it shall be conducted by the sanitary authority.

4. The midden system may be modified so as greatly to reduce nuisance and danger from it. We have described the form of midden-closet which we think presents fewest objections. We cannot speak of satisfactory safety in the use of even this form of midden-closet, partly because we hardly expect to see it carried out with daily emptying, and partly because the materials of the midden would probably be retentive of some excremental matters; but if, under certain circumstances, middens constructed as above should be tolerated, it would, we think, be scarcely less than essential, first, that they should, if in a densely populated neighbourhood, be emptied daily, or, under other circumstances, at least once a week; and secondly, that the arrangements for excrement removal should be wholly in the hands of efficient persons appointed by the sanitary authority.

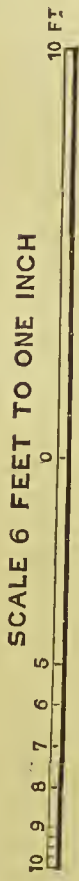
5. The pail system presents several advantages for poor town districts. It may safely be employed for excrement removal if movable pails of defined construction be used, and be changed every day for fresh pails. Such a system, involving similar construction or constructive alterations as are required for the toleration of a midden system, offers advantages over the latter

¹ Report of Medical Officer of Privy Council for 1869.

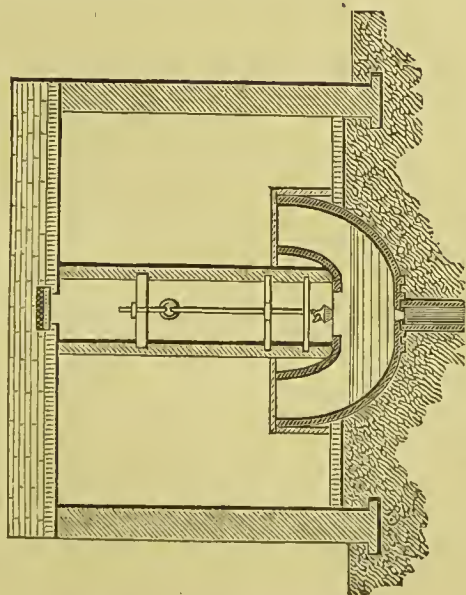
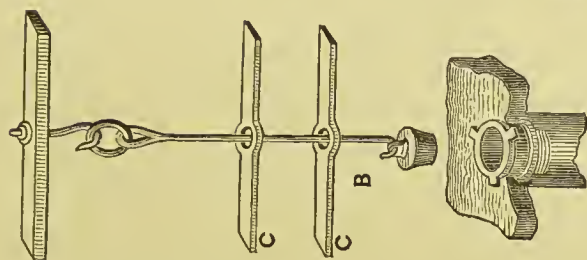
LIVERPOOL, TROUGH WATER CLOSET.



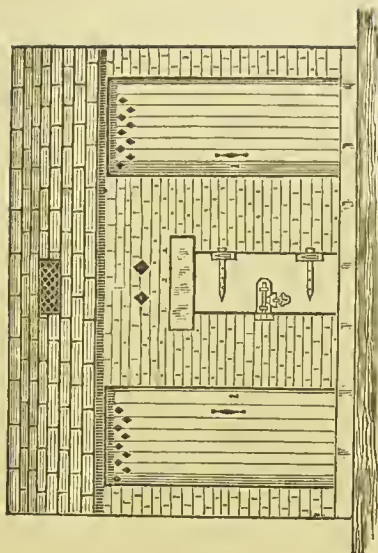
A. Water supply from Hydrant with Hose inside Chamber



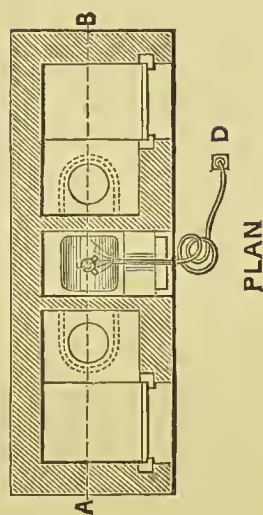




SECTION THROUGH A.B.

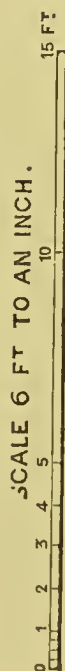


ELEVATION



PLAN

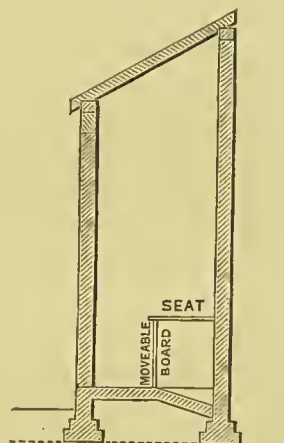
B Enlarged Drawing of Valve Guide rods (C), &c.
D Water Supply with Hose from Hydrant fixed in Court.



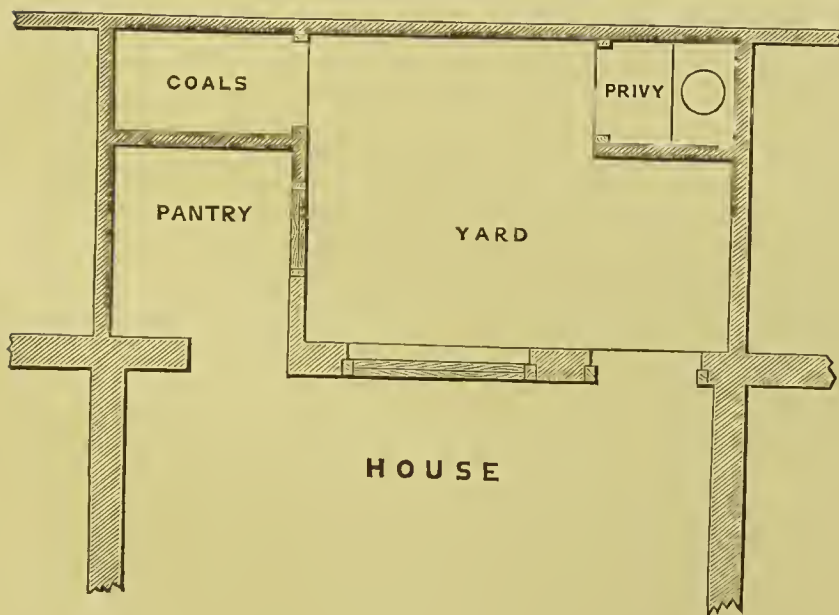


HULL.

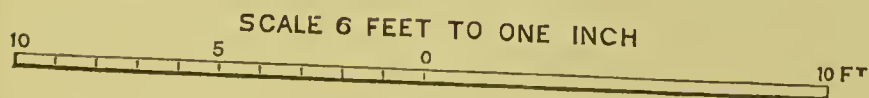
APPROVED CONSTRUCTION AND ARRANGEMENT OF ORDINARY PRIVIES,
WITH PLAN SHOWING THE SMALLEST YARD SPACE ALLOWED
IN NEW HOUSES.

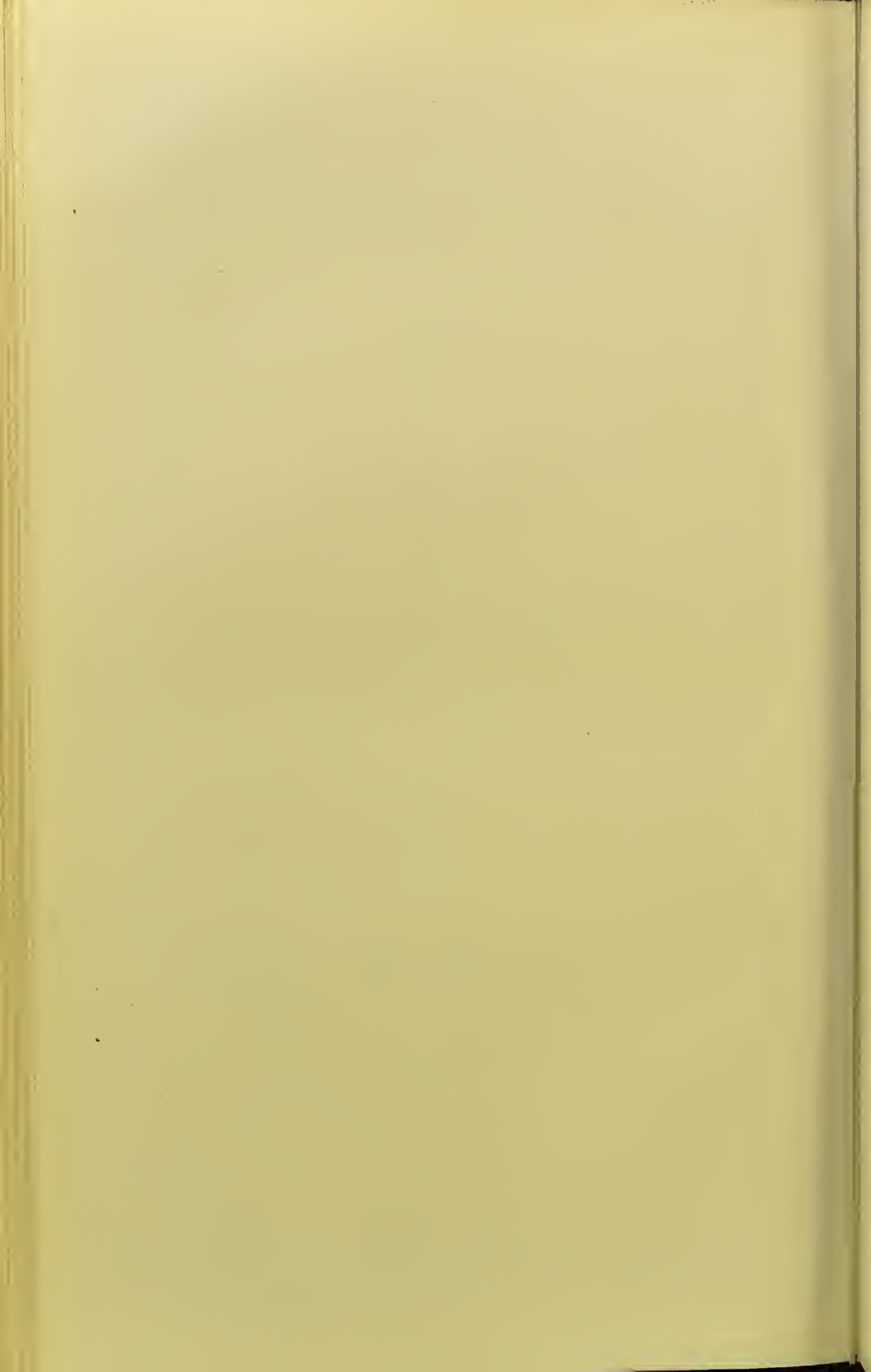


SECTION OF PRIVY



HOUSE





in regard of facility for frequent removal of excrement, in regard of safety from nuisance, and probably in regard of profit in disposing of excrement as manure.

6. Those who use the closet may, both under the pail and the midden system, be expected, with due superintendence, to do the cleansing of it so far as merely affects ordinary comfort and decency; but such action as concerns the effectiveness of the closet as a means of excrement removal must be taken by the sanitary authority itself.

7. If these conclusions be accepted, it follows that there are various demonstrable methods which will fairly answer the purpose of preventing nuisance and injury to health from the retention of excrement, at least until the perfection of arrangements for dealing with excrement shall be agreed upon. It cannot yet be affirmed of any one of the methods that it will develope into the only perfect system of the future.

A sensible article on the relation which faulty water-closet accommodations bear to the diseases of women appears in the *Philadelphia Medical Times* for August 23rd, 1873. It is contributed by Dr. William Goodell. He refers to the defective water-closet accommodation which prevails in the United States many of the diseases which commonly affect women. He advocates the construction of those essential adjuncts to every civilized dwelling in such a manner as would render them warm, dry, and free from draughts and foul air—private and easily accessible water-closets, constructed so as to induce females to use them more regularly than they do at present, because those places are cold, too public, and often too remote.

CHAPTER XXI.

UNHEALTHY OCCUPATIONS—POISONOUS COLOURS.

In the manufacture of various articles, solid particles, in quantities more or less considerable, are thrown into the atmosphere. Persons breathing air containing those solid particles, or dust, are often peculiarly liable to diseases of the respiratory organs; and, in some instances, other maladies are caused by the constant inspiration of dust-laden air. Large quantities of solid particles (dust, smoke, &c.) are thrown into the air during the preparation of snuff and tobacco, bacon, bone black, coke, various kinds of charcoal, plaster of Paris, tobacco pipes, tiles, crockery (where smoke-consuming kilns are not used), kelp, soda ash, pearl ash, steel, wadding, feathers, flour. The same nuisance is created by the roasting of aluminous shales, pyrites, coffee, &c.; by grinding drugs, clay, cement, &c.; in wire-drawing and steel-grinding works; by the treatment (thrashing, carding, hackling, spinning, &c.) of woollen, cotton, and linen textures. Solid particles are sent into the air in the act of sweeping chimneys, hewing coal, and beating

carpets. Amongst steel grinders the mortality from pulmonary disease is very high. According to Doctors Hall and Wynter, the duration of life amongst "dry grinders of forks" is 29 years; razor grinders, 31 years; edge-tool grinders, 32 years; spring knife and file grinders, 35 years; saw and sickle grinders, 38 years. In the factories where wet grinding is employed, and also where fans are used, the mortality is considerably less. Amongst coal miners cases of chronic bronchitis, emphysema, and "black lung" are very common. Cotton weavers suffer very much from the dust abraded from the size, or starchy matter, which stiffens the cotton cloth. The workers in shoddy mills, bone turners, workmen handling papers coloured with arsenical pigments, the women employed in the preparation of artificial flowers, and flax hacklers and spinners, are all more or less liable to injury from the inhalation of solid particles.

Dr. C. D. Purdon, of Belfast, states that the flax manufacturing operatives of Belfast suffer more from pulmonary disease than the other industrial classes, or the gentry and mercantile classes. Three-fifths of the mill-workers, and two-fifths of persons of the other classes, die from consumption, and the death-rate amongst the former is high. The remedies suggested for improving the health of the workers are—(1) That no half-timers be allowed to work before they are ten years of age, and in place of changing the sets every fortnight, that the strong and well developed, who are about twelve years old, be always kept in the morning set, and before being so placed that they should be re-certified by the surgeon to be fit for such employment; (2) That no half-timers be employed in the unhealthy processes, and that those who are so employed should be at least fifteen years of age, healthy and well-developed; (3) A thorough system of ventilation should be carried out in the rooms; (4) The wearing of the "Baker Respirator" made compulsory; (5) A quarterly inspection of the mill by the certifying surgeon, who shall see the effect the work has on the constitution of those engaged, and, if suffering from incipient disease, they should be obliged to cease working; also, there should be an examination on every fresh engagement; (6) The lodging-houses, &c., should be inspected regularly, and not more than a certain number allowed to inhabit each room.

Lead miners, painters, plumbers, whitelead makers, and (not often) type printers suffer occasionally from slow poisoning by lead, the chief effect being paralysis. Operatives who are not cleanly are most liable to the influence of the poison; and I am disposed to think that there would be fewer cases of "lead palsy" if strict attention were paid to the thorough and frequent removal of dirt from the person and clothes. Dr. Mapother mentions a fatal case of copper poisoning. The subject of it was a lad who had been wholly occupied in scraping green paint off old Venetian blinds and mixing the fresh colour. Brass founders often suffer from inhaling fumes of metallic zinc which are emitted by melted

brass. Gilders and looking-glass makers suffer from the inhalation of mercurial fumes. They should bathe daily, and work in well ventilated rooms. It is stated that ammonia sprinkled daily on the floors of places where mercury is used prevents the mercurial vapours from affecting the work people. Bakers, tailors, shoemakers, and other workers suffer from the effect of a constrained position, dyspepsia being one of the most common symptoms. The cramped position and hard work of the scrivener's hand frequently paralyzes it, producing "scrivener's palsy."

During the last dozen of years many articles and reports on the effects of the sewing machine (worked by foot power) on the health have been published. Dr. Vernois, in the *Annales d'Hygiene Publique*, Vol. VIII., 1862, ascribed to the use of these machines irritation of the sheaths of the flexor and extensor muscles, including severe attacks of cramps, occasionally followed by partial paralysis. He further maintained that females whilst learning to work with these machines often laboured under a peculiar nervous excitement. On the other hand, Dr. William Ord, in his report on the sanitary conditions of the needlewomen of London, states that, on the whole, the sewing machine proves beneficial rather than injurious to them. It enables them to add 50 per cent. to their earnings; whilst the exercise of the muscles of the legs and trunk renders less injurious the effects of a sedentary occupation. He admits, nevertheless, that the cramped position of the operator sometimes occasions thoracic pain, and produces indigestion; and also that, occasionally, delicate women become exhausted by the unaccustomed physical exercise, just in the same way that a clerk, if not robust, would become over-fatigued by working all day with a spade. Dr. Guibout, Physician to the Hospital St. Louis, Paris, and Dr. Fournier, shortly after the publication of Dr. Ord's report, published papers which gave a very bad account of the use of the sewing machine in the case of factory operatives. Dr. Espagne stated in the *Montpelier Medical Journal*, May, 1869, that, although it would be desirable to work the machines by artificial motive power, yet when used by foot power they do not produce any general malign influence upon the health of those operating with them. In 1870, Dr. G. Decaisne published a very exhaustive memoir on this subject in the 35th volume of the *Annales d'Hygiene Publique*, second series. He showed that sewing by means of machines exercised no more deleterious influence upon the health than arose from long-continued needlework of any kind.

Arthur H. Nicholls, from 138 replies made to an official inquiry, concludes:—¹

"That the sewing machine may be used by a healthy woman of average strength for three or four hours daily without causing excessive fatigue, or appreciable ill effect; and that the illnesses

¹ Third Annual Report of Massachusetts Board of Health.

which most frequently prevail among professional operatives making use of the treadle are :—

“Indigestion ; muscular pains, affecting the lower limbs and trunk, produced by the long-continued, frequent use of the same museles ; diseases peculiar to women, aggravated by, rather than caused by, the plethoric condition of the pelvic organs, induced by this exercise ; general debility, brought on by overwork ; other ill effects.”

Dr. Nichol thinks that the unhealthy tendencies of this occupation may be greatly diminished by the substitution of some other motive power than that of the feet, or the adoption of improved treadles.

The following table is extracted, some columns of statistics being omitted, from the Report of the New York Board of Health for 1872 :—

Table showing the influence of various occupations upon Phthisis Pulmonalis in New York City.

Occupation.	Deaths by Consumption in each 1,000 persons.
Labourers (including Quarrymen, Agricultural Labourers, and Porters)	11·5
Coopers	8·5
Machinists (including Blacksmiths and Metal-workers) ...	8·2
Lawyers	7·8
Seamen and Watermen, Boatmen, Boot and Shoemakers	7·7
Barbers (including Hairdressers)	7·2
Carmen (including Coachmen and Teamsters)	7·1
Printers	7·0
Painters (including Varnishers)	6·9
Masons and Stonecutters	6·8
Carpenters (including Cabinetmakers, Upholsterers, and Joiners)	6·6
Dressmakers (including Milliners, Mantuamakers, Tailor-esses, Seamstresses)	6·4
Teachers (Female)	6·0
Tailors	5·7
Bakers	5·5
Bookbinders	5·3
Cigar makers (including Tobacco-workers)	5·2
Domestic Servants	5·1
Butchers, Clerks (including Salesmen and Accountants in stores, banking, brokerage, insurance, and manufacturing establishments, and Civil Employees of Government) ...	4·6
Hatters (including Hat and Capmakers), Physicians and Surgeons, Pedlers (including Hucksters and Commercial Travellers)	3·8
Merchants (including Traders and Dealers)	3·1
Stablemen (including Livery Stablekeepers and Hostlers)	3·0
Teachers (Male)	2·2

Health of Sailors and Canal Boatmen.—According to Dr. Rattray, R.N., the impurity of the air in ships chiefly leads to

complaints of the respiratory and circulating systems, *e.g.*, catarrh, bronchitis, and phthisis.

Sailors have very limited sleeping accommodation, which is perhaps unavoidable; but there is no reason why there should not be ample ventilation of their sleeping places.

Many thousands of the inhabitants of the United Kingdom use the large boats and barges that ply upon the canals and rivers as dwellings. In Ireland there are more than 4,000 "boatmen," of whom a large proportion is employed on the inland waters. The sanitary conditions under which boatmen are placed are, therefore, a subject of considerable importance; and I propose to show that, so far at least as my observation extends, they are far from satisfactory.

I have inspected a large number of the boats which ply on the two canals that enter Dublin, and anything more insanitary than the condition of the cabins of the majority of them it would be difficult to conceive. These "dwellings" are rarely five feet, and sometimes not more than three feet, in height; only a small proportion of them are provided with windows, and their sole ventilators are the openings or hatches through which the men descend into their gloomy abodes. The crews of the boats sleep, cook, and sometimes wash in the cabins; their provisions are kept there, and very frequently the boat's dog or dogs are permitted to sleep in them. What becomes of the excreta and slops produced on board? Consigned not unfrequently, I apprehend, to the canal; and canals often afford the only water supplies to towns and villages. The following description of boats which I have recently examined in the Dublin canals by no means refer to exceptional cases:—

No. 1 Cabin, four ft. three in. in height, containing 400 cubic feet; lighted by two small windows about eight in. square each; a close stove, a bench bedstead, lockers, cooking utensils, &c. Two men sleep in the bed, and a boy sleeps in a "shake-down" on a bench. Only the latter had slept in the cabin the night previous to my examination (at eight, a.m.) the following morning. The cabin felt somewhat, but not very, close. The amount of carbonic acid was determined, and found to be .098 per cent. This amount, though above the normal standard of .04, is not very high; but then it would have been greater had not the two men who usually slept in the cabin been absent the night previous. Still, this cabin was in every respect superior to most of the others which I examined.

No. 2 Cabin, three ft. nine in. in height, seven ft. long, seven ft. wide = $183\frac{3}{4}$ cubic feet; three occupants (men), having respectively $61\frac{1}{4}$ cubic feet of space. The three men slept in one bed. The close stove had a turf fire blazing brightly in it (the morning was warm) at the time of my examination. The little cabin was crowded with utensils and odds and ends, by which the cubic space was still further diminished. There were no windows, and the only opening in the cabin was the hatch, two ft. by two ft.

The men had left the cabin an hour before my arrival, and the air in it was, no doubt, in the meantime somewhat purified; but I found the carbonic acid to amount to .34 per cent.

No. 3 Cabin, $3\frac{1}{2}$ ft. in height; 350 cubic feet. No windows; hatch, four feet square—no other ventilator. Stove, with fuel burning in it. Two men and a boy, all occupying one bed. The usual lockers, &c. The atmosphere felt very close, and contained of carbonic acid .365 per cent.

No. 4 Cabin, four ft. ten in. in height; 360 cubic feet of space. No windows; hatch, three square feet, and no other opening. A close, iron stove, with fuel burning in it. Three men sleep in one bed, one man in another, and two dogs on the floor. The place has a predominant odour of turf smoke, modified by various others—those of tobacco, herrings, &c. Very little light; none from the sun when the hatch is closed¹ during rain. The place swarms with bugs and fleas. The men had not long risen at the date of my visit. The air contained of carbonic acid .95 per cent. The air of the cabin in this boat felt very oppressive, and after remaining in it for half an hour I experienced the headache and other symptoms so often observed where the atmosphere is loaded with organic matter, and which Dr. Angus Smith has so graphically described in his report on the air of mines and in his work "Air and Rain."

That the atmosphere of such a place as that last described must be highly injurious to health needs no argument to prove in these days of sanitary enlightenment. One of the men in this boat, aged (he stated) forty years, appeared to be at least fifty. He was hollow-cheeked, thin, weak-eyed, and his muscles were very soft. He said that he had been only two years living wholly as a canal boatman, during which time he had lost strength and flesh rapidly, and he was so apprehensive of losing his life that he intended to give up his present pursuit. On inquiry, I find that large numbers of boatmen complain of loss of health; and, as their occupation is healthy and not too laborious, their decay of vigour and health must be due to the scandalously bad sleeping accommodation provided for them.

According to the provisions of the 32nd section of the Sanitary Act, 1866, a ship or boat is to be regarded as a house or dwelling. Therefore there is no reason why the sanitary authorities, urban and rural, should not look after the health of dwellers in those floating houses. The 19th section of the same act defines as a nuisance any house or part of a house (ship or boat) so overcrowded as to be injurious to health. In the cabins of the Irish canal boats the space per head varies from 40 to 120 cubic feet. These floating dwellings have no earth closets or other contrivance for receiving excreta. I suspect that the effete matters produced on board are for the most part dropped into the water. Ballot

¹ During rain and in winter, when the hatch is closed, there is no opening whatever by which to admit air; it must come through the chinks.

found that cholera in Holland travelled along the canals. We can now understand why.

The proper remedies for the sanitary defects of canal boats are as follows:—Increased size of cabin. This could be effected by projecting its roof two or three feet above the level of the deck, and this change would allow of proper windows being placed in the cabins. For each person sleeping in the cabin the minimum space should be 220 cubic feet; the ventilating openings to be four square feet per head. The cabins should be placed in the stern and not in the bows, the latter being sometimes the situations selected. McKinnell's ventilator is the most useful one for cabins, as it introduces pure air through the roof, and permits the escape of vitiated air through the same place. It does not promote decency or morality to permit three or four men and boys to sleep in one bed; therefore for each occupant of a boat-cabin a berth or hammock should be provided.

Poisonous Colours.—Disease is occasionally produced by the employment of arsenious acid as a pigment for wall paper, textile fabrics, and artificial flowers. Two compounds of arsenious acid are largely employed as pigments—namely, hydrocupric arsenite (Scheele's green) and the aceto-arsenite of copper, or Schweinfürt green. Both pigments are usually confounded by workmen, and are termed Brunswick, Vienna, emerald, or emerald mineral, green. The arsenite contains 55 and the aceto-arsenite 58 per cent. of arsenious acid, or white arsenic. Both of these arsenical compounds are brilliant and enduring pigments; and a great temptation to use them is their cheapness. In England the consumption of these pigments cannot be less than 700 tons per annum.

Dr. F. H. Draper gives¹ a long list of accidents that have occurred from the use of arsenical pigments. Professor Gmelin, of Heidelberg, appears to have been the first to direct attention to the danger to which persons were exposed who lived in rooms the walls of which were coloured with arsenical pigments. Cases of disease from this cause are recorded by Dr. Halley, of London, Dr. James Whithead, of Manchester, Dr. W. E. Rice, of Boston, and other medical men; and in the works on medical jurisprudence numerous instances of poisoning by means of arsenical wall paper are to be found. Indeed, although there have been doubts expressed as to the possibility of the colouring matter on walls ever being taken into the system, there is a mass of evidence which, to my mind, clearly establishes the fact. Two undoubted cases have come under my own observation.

Arsenic is not volatile under 360° Fahrenheit; therefore, when a poisonous effect is produced by arsenical wall paper it must be owing to the inhalation of fine particles of the pigment. The dust on shelves in rooms coloured with Scheele's green has repeatedly been examined and found to contain arsenic. Chevalier, of Pietra-

¹ Third Annual Report (for 1871) of Board of Health, Massachusetts.

Santa, Kirchgasser, of Coblenz, and others, believe that in addition to the diffusion of arsenic in dust throughout a room, the poison is sometimes dissipated in a gaseous form, probably as arseniuretted hydrogen, and that it may be recognised in the suspected room by its garlic-like or musty odour.

I have seen the blood pour abundantly from the nose of a man whilst engaged in hanging unglazed bright green paper; and he told me that he often suffered for weeks after a similar task. The paper-hangers of Dublin wear thick veils when hanging paper coloured with arsenite of copper. So far as my experience goes, the larger portion of the green paper on sale in Dublin is coloured with arsenite of copper. A rough mode of ascertaining whether or not a wall paper is coloured with arsenical green is to moisten it with solution of ammonia. If arsenite of copper be present the ammonia will strike with it a blue colour, similar to that on the green paper here shown—a specimen of a wall paper on sale in Dublin. Carbonate of copper, which is used but rarely to colour paper, will, of course, give a blue colour with ammonia.

Arsenical greens are used largely to colour artificial flowers, and they are also, but to a less extent, employed in tinting muslins and tarlatans. Dr. Hillier stated in 1861 that the London artificial flower makers commonly suffered from chronic inflammation of the digestive organs, from irritation of the eyes, and the skin of the hands, neck, and scalp; moreover, they suffered from general nervous debility and prostration. The effects were attributed to the constant contact with arsenical powder. In 1861 a girl, aged nineteen, who had been engaged for eighteen months in the preparation of artificial flowers, died after exhibiting the characteristic symptoms of chronic arsenical poisoning. After death the presence of arsenic was actually detected in several of the internal organs.

The amount of arsenical green in artificial flowers, leaves, and fruit is often very considerable; for example, Professor Hoffmann detected ten grains weight in a single twig of ten leaves. In coloured muslins the amount of the poison is also occasionally somewhat large, and we can hardly wonder that many ladies have been poisoned owing to arsenical dust from their brilliantly coloured dresses finding its way into their lungs and stomachs.

At the meeting of the British Medical Association at Birmingham, in 1872, Dr. Hill, the borough analyst, mentioned cases of poisoning from emerald green which had come under his own notice. He condemned strongly the reprehensible practice of employing poisonous pigments for the purpose of colouring toys, for young children had a habit of putting their toys into their mouths.

Poisonous Dyes.—The feeling which induces people to keep off the *appearance* of old age as long as possible sometimes leads them into practices which shorten their lives. The use of dangerous hair-dyes is an example of this kind. Many hair-dyes are harm-

A M M O N I A

STRIKES THIS

B L U E

COLOUR WITH

ARSENICAL GREEN.

less; but the majority of those now in use are, to say the least, open to very grave objection. Silver salts are employed, but they irritate the skin and hasten baldness. The "hair restorers," which are described by the vendors as agents which maintain the colour of the hair, and restore it, if altered, to its former hue, are, in reality, slow dyes. I have examined several of them, and find that they consist, with few exceptions, of salts of lead (generally the acetate) and sulphur, with, of course, a little perfume. In some cases I have known them to be used for a long time without any apparent evil results; but I believe that in many instances these lead dyes act injuriously. Several cases of lead poisoning by saturnine hair-dyes are on record; and during the present year Dr. W. Neftel, of New York, stated in the *Medical Record* that he met with three very severe cases of lead palsy, combined with vaginismus, which could only be attributed to the use of cosmetics containing lead. Lead dyes for the hair are now used very extensively.

A specimen of a colourless fluid used at the present time for the purpose of giving dark hair the fashionable, *i.e.*, yellow colour, was submitted to me for analysis. Very much to my surprise, I found it to consist solely of peroxide of hydrogen, or oxygenated water. Curiously enough, chlorine, instead of bleaching hair, rather darkens its hue.

The *Bulletin de l'Academie Imperiale de Medicine*, February and March, 1869, contains communications from Dr. Ambroise Tardieu on the poisonous effects of the new ^{lye} termed *coraline*. He states that it should not be employed for the purpose of dyeing articles of clothing which are intended to be worn next the skin. The author had satisfied himself that this pigment was frequently absorbed by the skin, on which it produced "characteristic eruptions." Dr. Tardieu also directs attention to the fact that aniline and others of the new dyes, and even cochineal red, often contain notable quantities of arsenic, mercury, and lead. According to Tardieu, coraline red may be distinguished from the other red dyes by the following tests:—It does not dissolve in cold water; it gives up a little of its colour to boiling water, but it is rapidly and completely decolorized by boiling alcohol. It is not affected by alkalies, but acids precipitate the colouring matter in the form of brown flakes.

M. Roussin has also experimented with coraline red, and obtained results similar to those arrived at by Tardieu; but the conclusions of both are called in question (*Journal de Pharmacie et de Chimie*, August, 1869) by M. Landrin, a veterinarian. This gentleman experimented upon some of the lower animals, and found that they did not absorb solution of coraline through their skins; and that this substance administered by the mouth and by the hypodermic method did not produce effects which would justify its being termed a poison.

The numbers of the *Journal of Cutaneous Medicine* for July

and October, 1869, contain the particulars of several cases of dermatitis produced by coloured stockings, and two undoubted cases of this kind have come under my notice.

CHAPTER XXII.

HYGIENE OF IRISH TOWNS.

The condition of most Irish towns is anything but favourable to the maintenance of health and prolongation of life. The streets are not properly cleansed, and they are frequently too narrow. The houses are often not supplied with yards or gardens, front or rear. In the poorer quarters they are generally overcrowded, out of repair, and filthy. Even in houses where the better portion of the lowest classes live, the accommodation is defective and a disregard of cleanliness conspicuous. In the open country the dwellings of the labourers are quite as bad as the tenement houses of town purlieus. I have seen a large family occupy a single room, in which the fowl and pigs and calves were housed, and in which dairy operations were carried on—the milk pan being placed under the bed (the only secure place), to throw up its cream. Dr. Tucker, Medical Officer of Health for Sligo, states of a cabin occupied by a nobleman's tenant: "It was about 12 feet wide and 24 feet long. The domestic circle, happy family, or menagerie, that dwelt therein consisted of a sick man, his wife, four daughters, one son, three cows, one horse, two calves, two pigs, and poultry, all in one common undivided house, no partition; generally the pigs dwelt beneath the bed, the people in them, and the poultry over head. They can enjoy the prospect of bacon and chickens, which they seldom taste." Although there are still thousands of one-roomed dwellings in Ireland, yet it is satisfactory to learn that each decennial census shows a steady decrease in the relative numbers. With respect to families, there is no law to compel the separation of their unmarried males and female members. In towns of more than 3,000 inhabitants, and which are placed under the provisions of the Improvement Act of 1854, the lodging-houses may be inspected, and regulated in reference to ventilation, overcrowding, privy accommodation, separation of the sexes, &c. The thirty-fifth section of the Sanitary Act of 1866 enables urban sanitary authorities to prescribe rules (subject to the approval of the Local Government Board) for the tenement houses. The following rules are those in force in the case of the 9,000 tenement houses of Dublin.

Every house or part of a house let in lodgings, or occupied by

members of more than one family, shall be subject to the following regulations:—

I. That no greater number of persons shall occupy any room in any such house than can be accommodated with 300 cubic feet of space for each (for example, a room 10 feet high, 15 feet long, and 10 feet wide, contains 1,500 cubic feet of space, and may therefore accommodate 5 persons).

II. That said authority, or any of its officers, may enter and inspect any such houses, or any apartments or appurtenances thereof, without let or hindrance, between the hours of 10 A.M. and 4 P.M., for the purpose of carrying into effect these regulations and the provisions of said act, or in special cases at any other time, upon the signed requisition of the chairman of the committee of said authority, by vote of the committee and not otherwise; and may inspect and measure the dimensions of each room, and affix on the door thereof a description of the cubic contents of such room, in a form to be provided by such authority, and any removal or defacement of such certificate shall be deemed a breach of these regulations.

III. That the owner of every such house shall have supplied thereto a properly-constructed ashpit and privy, or water-closet, or privies or water-closets sufficient to accommodate the inhabitants thereof, and a properly-trapped house-drain communicating with the main sewer (if any within 100 feet from such house), and if no such main sewer, then with a proper cesspool; and shall cause privies, water-closets, ashpits, cesspools, and house-drain to be kept cleansed and in proper repair, and shall also provide for each such house a sufficient supply of pure water; and keep the roof, external walls, and chimneys of such house in reasonable repair, impervious to wet; and shall cause each window of such house to be made capable of being opened from the top, or raised from the bottom, or otherwise opened to the extent of the half of each sash, and shall cause the entrance and hall, rooms, stair-cases, and lobbies thereof to be put and kept in good repair, and in a cleanly and ventilated state; and no room shall be let or used as a sleeping apartment unless it shall have at least one window; and all yards, halls, staircases, passages, and rooms not papered or oil-painted, he shall cause to be lime-washed at least every six months. Within the provisions of this regulation the word owner shall mean the person or persons who for the time being shall be in receipt of the rents of the lodgers or other occupiers of such premises.

IV. That no occupant residing in any such house, nor any other person, shall throw from any window or other opening to or upon any roof, shed, yard, passage, or street, any water, foul liquid, or other offensive matter or thing, or shall throw or drop same in or upon any common entrance, stair-case, lobby, street, or place other than that provided for the proper deposit thereof, and every occupant or other person shall so use any requisite in or appurtenant to any such house as not to injure or break same, or render ineffective, or put same out of order.

V. For every offence against any of these regulations, or any portion thereof, the party so offending is hereby subjected to a penalty of not more than 40s. for any one offence, with an additional penalty not exceeding 20s. for every day during which a default in obeying such regulation may continue, and such penalties shall be levied, recovered, and applied as is provided by said act.

VI. That the said authority may, with the consent of the Lord Lieutenant¹ in Council, vary, alter, amend, add to, or rescind in part or in the whole any of the foregoing regulations as may from time to time be deemed expedient.

The Artisans and Labourers' Dwellings Act, 1868, enables local authorities to cause these dwellings to be kept in repair, shut up or demolished, according to their condition, and on order from the courts of law. They may also borrow money from the Board of Works for the purpose of carrying out the provisions of this act. Through the benevolence of the late Mr. Peabody, large blocks of convenient dwellings for the working classes have been erected in London; and companies and individuals have provided similar structures in other towns—Dublin, for example—with similar healthful, convenient, and cheap dwellings. They are, however, as yet only few and far between; and of the 100,000 dwellers in the tenement houses of Dublin, not 1 in 500 is located in the model lodging-houses. The local authorities have power to provide dwellings for the working classes under the provisions of 29 and 30 Vic., c. 44.

Parks and Recreation Grounds.—The Public Parks Act (Ireland), 1869—(32 and 33 Vic., c. 28)—enables the governing body of any town exceeding 6,000 in population to provide public parks for the use of the inhabitants. It is to be hoped that this act may be generally put into force; for undoubtedly it is desirable that those who live in crowded houses and narrow streets and courts should occasionally be able to “breathe a little fresh air” in a cheerful place. Children's recreation grounds should, of course, be in or close to the town, otherwise they could not be much used by the younger children.

Disposal of the Dead.—It has recently been proposed to burn (*cremate*) the bodies of the dead, instead of consigning them to the earth. The plan proposed, and, in a few cases, carried out (as lately at Dresden) is to place the body in an iron open coffin and reduce it to ashes by means of a hot blast of 1,000° Fahr. The volatile matters given off during cremation are to be passed through a furnace and therein completely burnt. It is probable that cremation may shortly come into use in many cities.

Before the practice of intramural interments was prohibited by the legislature, the condition of many of the burial places in towns was shocking in the extreme. So numerous had been the inter

ments in some of the London churchyards, that the surface soil was almost wholly composed of human remains. According to the present state of the law, no interment can take place within two miles of the metropolis. In Dublin, intramural burials are very rare. There are three cemeteries situated in the immediate vicinity of the city, and every precaution is adopted to prevent them from polluting the atmosphere. I wish I could speak so favorably of the state of the burial places in other parts of Ireland; but, unfortunately, many of them—especially in the smaller towns—are in a most neglected condition. I have seen graveyards where the relics of poor mortality met the eye in every direction, and where two or three inches of clay were considered a sufficient covering for the tenement of the dead.

Although badly kept and overcrowded graveyards are serious nuisances, still, when cemeteries are properly managed, I do not think they are at all injurious to the public health.

Cemeteries should, undoubtedly, be placed outside of towns, and also under the management, or at least constant supervision, of the local sanitary authorities. If they are properly managed, there is no reason why they should prove injurious to public health. Let us assume the case of a cemetery of three acres: the graves varying from 5 to 8 feet in depth and the interments averaging 100 per annum. As the greater number of persons interred are children, and as adults are usually greatly emaciated before death, the average weight of corpses is probably not more than 50 lbs. If we assume that the absorbent soil of the cemetery is only 8 feet deep, then 3 acres of it weigh 2,650,000 lbs., and annually receive 5,000 lbs. weight of human remains, or 0.1825 per cent. of the weight of the soil. It must, however, be borne in mind, that more than four-fifths of this animal matter consist of water and earthy and saline substances, so that, in fact, only about 1,000 lbs. of dry organic matter, capable of being converted into gases, are annually placed in the soil. Small as this quantity of animal matter is, if it were allowed to accumulate in the soil, it would, after a few years acquire dangerous proportions; but it becomes re-organised into vegetable forms, or in an altered and harmless state is carried off in the drainage. If the graves were covered with grass the crop would amount to about 12 tons yearly; but as the graves would be frequently opened, I shall assume that only 3 tons of grass are obtained. The proportion of decomposable matter in grass varies from 20 to 35 per cent. Let us say that in the cemetery it contains 20 to 35 per cent., from which it follows that there are annually removed from the cemetery 1,680 lbs. weight of (dry) vegetable organic matter, whilst it receives in the same period 1,000 lbs. of (dry) animal organic matter. The decay of the coffins is not productive of any injurious effect upon the atmosphere. Thus it is evident that the vegetable matter removed in the form of grass from the cemetery carries off from it a greater amount of organic matter than the soil receives in the form of ani-

mal matter. A heavily manured field would receive at a single application a much larger quantity of organic matter than would be deposited in such a cemetery as I have described in a year. Forty tons of stable dung in a state of decomposition are often spread over an acre of arable land; such an application would contain five or six times as much (dry) organic matter as a well kept cemetery would yearly receive. Any burial ground which is over-crowded and dangerous to health may be closed by an order of the Local Government Board; before whose Inspector evidence as to the state of the place must be given—19 & 20 Vic., c. 98, and 23 & 24 Vic., c. 76, relate wholly to the burial of the dead in Ireland. Sections 5 and 6 of Vict. 11 & 12, c. 65, are incorporated with the first of the former acts, as are also sections 65 to 74, 10 Vict., c. 16, and sections 26, 32, and 33 Vict., c. 42, Irish Church Dis-establishment Act.

CHAPTER XXIII.

EXERCISE—BATHING—CLOTHING.

Exercise.—Persons whose occupations compel them to lead sedentary lives are not in general so vigorous or long-lived as those whose pursuits are of an active kind. Exercise promotes rapid changes in the composition of the tissues, and therefore increases the desire for food. It causes a copious exhalation of moisture, which stimulates the functions of the skin. Under its influence the muscles increase in size and power. Dr. Edward Smith has determined the effect of exercise upon respiration. Some of his results are shown in the table.

Table showing the relative quantities of air breathed by a man under different conditions.

Lying down	...	...	100	Walking 3 miles per hour	...	322
Sitting	...	...	118	„ 4 „ „	...	500
Standing	...	...	133	Running 6 „ „	...	700
Singing or Reading aloud	...	...	126	Rowing	...	333
Walking 1 mile per hour	...	...	120	Riding (trotting)	...	405
„ 2 miles per hour	...	...	276	Swimming	...	550

Walking in the open air is very healthful, more especially if the pedestrian select a new route for each ramble. When exercising the body, the mind should not, if possible, be allowed to dwell upon the cares and anxieties of business; but it is difficult to accomplish this object, if the daily walk reveals nothing new to attract the attention. How different is the sensation experienced during

a saunter by the sea-side, through fields, a large park, or even amongst the suburban avenues, with their semi-rural appearance, from the melancholy feeling with which we take a prescribed walk up and down a dull street or round a city square? A walk of twenty miles is equal to a day's hard work. Those whose occupations confine them to the house should walk at least three miles daily. The mind and body cannot simultaneously be fully worked; therefore those whose occupations require a large expenditure of brain power should not take excessive exercise—they should not walk more than five or six miles a day. It is only in walking that women can at all approach men in developing motive power. I have known a small and delicately-formed lady to take walks of from twelve to twenty miles without suffering from over-fatigue. She had gradually disciplined her muscles to the healthful exercise. This kind of exercise is of so gentle a character that it is peculiarly suited to the weaker sex; and if they take it regularly, they will find a decided improvement in health and strength. Pedestrians should not be overclad, nor should their clothes prevent the free play of the muscles. When walking, our comfort depends, in no small degree, upon the kind of shoes or boots which we wear. The vanity which induces people to squeeze their feet into tight boots is a common preventive of healthy exercise. How can a person afflicted with corns or bunions enjoy a walk?

Swimming, rowing, and riding on horseback are all excellent kinds of exercise; so also would be dancing, were it not usually performed in the vitiated air of the crowded ball-room. The dances termed "fast" are, indeed, a little too fast; they overheat the body and produce too rapid an acceleration of the heart's action. Gymnastics are now practised in nearly all boys' schools; but they have not come into general use in girls', where they are more required. Boys, during playhours, indulge in various pastimes of an active character; but the outdoor exercise of boarding-school girls is too often confined to marching in formal procession, marshalled by a governess, through dull streets or roads. I have already stated that monotonous exercise is the least beneficial, and we would, therefore, strongly urge the necessity for having playgrounds attached to girls' schools. There are excellent games in which girls, and indeed women also, could join without incurring the charge of unsexing themselves. Croquet is an admirable exercise—not too violent, but just sufficiently active to cause a healthy play of the muscles; besides, it induces the performers to remain in the open air. Every kind of moderate exercise which involves no breach of feminine propriety should be encouraged amongst girls.

Running, leaping, and throwing heavy weights are very severe forms of exercise; and if practised with a view to competition, we doubt if they are not, on the whole, injurious rather than beneficial. When the pulse rises to 120, the exercise should be discon-

tinued, at least for a time. More than one case of ruined health, the result of excessive gymnastic exercises, has come under my own observation. The athletes of ancient Greece and Rome were a very short-lived class; and the same may be said of the modern prizefighters, professional pedestrians, and acrobats. Cricket is a game which does not overstrain the muscles, and I would therefore recommend it before all others. Rifle shooting is a capital exercise, and so also are nearly all kinds of rural sports. Violent or prolonged exertion of any kind should never be undertaken without previous preparation, or training; for otherwise the heart and other muscles might sustain permanent injury.

In training for any kind of severe exercise, great attention must be paid to diet and to the habits of every-day life. Early rising, regularity in eating, and perfect cleanliness of the skin, are important points. An animal diet is preferable to a vegetable regimen, and the meat should be easily digestible, and not over fat. Starches, being somewhat difficult of digestion, should be sparingly used. Alcohol, tobacco, and snuff are inadmissible, but tea and coffee may be used in moderation. A complete bath should be taken at least once a day, and the surface of the skin subjected to friction. Eight hours' sleep will not be too long. Much exercise is not desirable before breakfast, because at that time the stomach is without food; but that meal should be taken as early as possible. Many persons practise severe exercise for a few days or weeks, and then abandon all active habits for perhaps a few months. This is what might be well termed the *intemperance* of exercise. Regularity in the motions of the body, as in everything else, is desirable; and men should always be in sufficient training to enable them to take a long walk, or to play a good game of cricket, with the certainty that they would not suffer from muscular pains on the following day.

The mind, like the body, can be overworked and underworked. A large class of persons never dream of giving their brains a holiday, but work them incessantly, until the springs of life utterly fail. Some of these persons often attain to an advanced age, but a large proportion of them prematurely exhaust their intellectual powers. Insanity and paralysis are the most usual results of excessive mental labour. For intellectual workers physical exercise is absolutely necessary, and it should be of that kind which least engages the reflective faculties. Men occupied in office work of a merely routine character may safely play the most scientific game of chess, or read the most ponderous articles in the driest numbers of the *Quarterly Review*; but for statesmen, overworked public functionaries, barristers, physicians, and, in a word, all who have hard brain work to perform, the study of "light" literature is the only safe intellectual stimulus during their leisure hours. It is stated that the late Sir Robert Peel made it a practice to read some light literature after passing fatiguing nights in the House of Commons, and thereby relieved himself of some of the weight of cares which otherwise might have banished sleep from his pillow.

Baths and Wash-houses.—It would be desirable if the working classes could procure a cold bath for a halfpenny, and a warm one (with soap in either case) for 2d. If baths for this purpose were erected in the more densely populated districts, they would, no doubt, be generally used. I fear public wash-houses would not, in Ireland, be so frequently taken advantage of, judging from past experience.

The connection which exists between public bathing and the rate of mortality has recently been pointed out by Dr. J. Griffiths, Medical Officer of Health for Sheffield. During the winter months the public baths of that town are not much used, although in the summer months they are largely taken advantage of. As most likely few visitors to the baths have accommodation for bathing at their own houses, the inference is that those large numbers of people who bathe frequently in warm weather remain unwashed during the cold weather. With a view to elucidate the result of this want of cleanliness, tables were prepared, and with the following results :—

For five of the coldest months of the year 1871, with the mean temperature 31·9 degrees, the bathers numbered 996, and the number of deaths in the same period 723 ; whilst during the five hottest weeks, with summer diseases prevalent, with a temperature of 62·34 and 20,200 bathers, the deaths numbered 708 only. In 1872, for the corresponding period (five weeks), with a mean temperature of 30 degrees, there were 1,801 bathers, and 623 deaths ; during the warm weather, when the temperature was 65·34 and 18,147 bathers, the deaths were 597. In 1873 the figures were at 33·98 degrees Fahr., 1,970 bathers, and 636 deaths ; and at 61·7 degrees of heat, 18,463 bathers, and mortality 654.

When the skin becomes diseased, the work which it performs is, to some extent, thrown upon the lungs and kidneys, which are often found unable to accomplish the increased labour, and, therefore, also become diseased, either in their structure or functions. A common cause of the disordered functions of the skin is inattention to personal cleanliness. If the body be not thoroughly washed, the pores become filled with the saline and semi-organized matters which form the solid constituents of the perspiration. Diminished perspiration produces many kinds of skin diseases, more especially those eruptions termed pimples ; and the blood, not being perfectly freed from the effete matters it contains, becomes an unhealthy fluid, and is liable to produce fever and various other maladies. Mere contact with water is not sufficient to preserve the skin in a healthy state—soap must be liberally employed, so that the fatty exudations from the sebaceous follicles may be dissolved and removed. The scarf skin, undergoing incessant friction, rapidly breaks into dust, or “dandriff.” This dust also helps to fill up the pores, but it yields to the action of soap, and may, to a great extent, be got rid of by the use of the flesh brush and coarse towel, or “huckaback.” Those who desire a soft, clear, and healthy skin are most likely to.

obtain their wishes by washing it frequently—the best cosmetic is soft water.

A complete bath should be taken daily, or, at least, the whole surface of the body should be well sponged with soap and water. A hard white soap, without an excess of alkali, is the best kind to use. Considerable friction may be employed, so as to get rid of the worn-out cuticle, and to cause the blood to circulate briskly through the true skin, thereby stimulating its functions. Warm baths cleanse the body better than cold water; but they are not so bracing, and are much better adapted to a state of disease than to that of health. Nothing is more invigorating than the cold bath; but in severe wintry weather, and especially in the case of children and delicate persons, the temperature of the bath may be temperate or nearly tepid. A bath in the sea should not be taken more than once daily, and never immediately after a meal. Sea-bathing is very invigorating. It promotes appetite, strengthens the muscles, and increases the capability of enduring fatigue. It rarely fails to prove useful in the case of chlorotic girls and scrofulous children. The best time to take a sea bath is when the body is moderately warm; for if the circulation be feeble, cramps may occur; and if the body be too highly heated, the sudden change of temperature may cause injurious effects. A prolonged sea bath lowers the temperature of the body, and often occasions cramps; five or ten minutes' immersion is sufficiently long. On emerging from the sea a roseate hue should pervade the surface of the body—a pale bluish colour indicating that the bath has been too long a one. Dressing should be performed as expeditiously as possible, and a brisk walk will cause the circulation of the blood to proceed vigorously. In the case of delicate persons a mere plunge into the sea will often be found sufficient to produce a healthy reaction.

The Turkish bath is admirably adapted for the treatment of various diseases, but only under medical advice; for there are maladies that are aggravated rather than benefited by its use. In health it is found beneficial to most people who use it; but very weakly persons, and those of full habit, should be cautious in exposing themselves to the extreme variation of temperature which distinguishes the Turkish bath. When the perspiration is checked, that function is often restored by the use of the Turkish bath; and if the shampooing process be gone through, the amount of scarf skin removed will prove how thoroughly the sweat-ducts have been cleansed.

The following admirable lines written by Sir Alfred Power, Vice-President of the Local Government Board of Ireland, express forcibly the necessity of taking proper care of the skin:—

PRECAUTIONARY HINTS ON THE THREATENED APPROACH
OF CHOLERA.*The Skin.*

There's a skin without and a skin within,
A covering skin and a lining skin ;
But the skin within is the skin without
Doubled inwards, and carried completely throughout.

The palate, the nostrils, the windpipe, and throat
Are all of them lined with this inner coat ;
Which through every part is made to extend—
Lungs, liver, and bowels, from end to end.

The outside skin is a marvellous plan
For exuding the dregs of the flesh of man ;
While the inner extracts from the food and the air
What is needed the waste in his flesh to repair.

While it goes well with the outside skin
You may feel pretty sure all's right within ;
For if anything puts the inner skin out
Of order it troubles the skin without.

The Doctor, you know, examines your tongue
To see if your stomach or bowels are wrong ;
If he feels that your hand is hot and dry,
He is able to tell you the reason why.

Too much brandy, whiskey, or gin
Is apt to disorder the skin within ;
While, if dirty or dry, the skin without
Refuses to let the sweat come out.

Good people all ! have a care of your skin,
Both that without and that within ;
To the first you'll give plenty of water and soap,
To the last little else beside water, we'll hope.

But always be very particuilar where
You get your water, your food, and your air ;
For if these be tainted, or render'd impure,
It will have its effect on your blood—be sure !

The food which will ever for you be the best
Is that you like most, and can soonest digest ;
All unripe fruit and decaying flesh
Beware of, and fish that is not very fresh.

Your water, transparent and pure as you thinkit,
Had better be filter'd and boil'd ere you drink it,
Unless you know surely that nothing unsound
Can have got to it over or under the ground.

But of all things the most I would have you beware
Of breathing the poison of *once breathed* air ;
When in bed, whether out or at home you may be,
Always open your window, and let it go free.

With clothing and exercise keep yourself warm,
 And change your clothes quickly if drench'd in a storm ;
 For a cold caught by chilling the outside skin
 Flies at once to the delicate lining within.

All you who thus kindly take care of your skin,
 And attend to its wants without and within,
 Need never of Cholera feel any fears,
 And your skin may last you a hundred years !

Clothing.—The raw materials from which clothing is made should be light, bad conductors of heat, porous, and durable. Weight for weight, wool is much superior to cotton, and linen is not equal to calico, with respect to porosity and heat retention. The texture of woollen cloths can hardly be too fine. A flannel shirt, though perhaps not so pleasant to wear as a soft cotton one, is more healthy ; for in winter it keeps the body warmer, and in summer it absorbs the perspiration. The Bradford and Hull woollen manufacturers might make a finer and thinner fabric, adapted for inner garments. A mixture of cotton and wool might be found a good shirting material. In only one respect are cotton and linen superior to wool, and that is, they do not shrink so much under the action of soap and water. India-rubber clothing prevents the escape of perspiration, and should only be worn during severe weather, and even then not habitually. Coats made from this material should be very wide, and provided with ventilating gussets. No other material is so well adapted for keeping out wet and wind, and its lightness renders it superior to leather, which is so excellent a protection against the influence of rainy and tempestuous weather. The use of india-rubber overalls is not permitted, on hygienic grounds, in the French army, and they are proscribed amongst the London postmen. Furs are very bad conductors of heat, and are therefore highly prized as clothes in cold and temperate climates.

During infancy and childhood nature is less able to resist external influences, therefore young people should be more warmly clad than adults. No greater mistake can be committed than that of allowing the limbs of tender infants to be bared to the piercing blasts of winter, from the absurd notion that the exposure “hardens” them. I have often thought that the mother’s heart must be “hardened” too, when she could look, unmoved, on the poor little shivering specimens of humanity, returning, with pinched features and purple limbs, from their miserable walk. Is it not almost incredible that parents will insist on exposing their children, half-naked, to a temperature which they shrink from encountering themselves, unless when well protected with warm clothing ? Scotch soldiers who wear the garb of the Highlanders suffer much from rheumatism, owing to the exposure of their legs to the air ; and it is probable that the tendency to this disease, which is now so general amongst all classes of society, is, to some

extent, the result of defective clothing. Aged persons require extra clothing.

Men's clothing at the present time is more natural than women's apparel. Their tall hat is a warm covering, but it is unsightly, and prevents evaporation from the head. Shoes, as a general rule, are worn too tight, and as a necessary consequence, almost every one is troubled with corns, bunions, "irregular toe-nails," or overlapping and disjointed toes. I fear the feet of many beautiful but fashionable ladies would not bear to be investigated from an æsthetical point of view. In order to preserve the natural form of the feet, boots should have low and broad heels, wide toes, and be neither too large nor too small. The inner line of the shoe or boot should be perfectly straight. The high-heeled boots now so generally worn by ladies have a tendency to produce atrophy (or wasting) of the muscles of the leg, whilst they cause those of the ankles to become thickened—results not at all to be desired. Hard leather often produces corns. Patent leather prevents the evaporation of moisture from the feet, and is liable to produce tenderness of the skin and other disorders of the feet. In the act of walking the foot expands from one-sixteenth to the one-tenth of its length, and its lateral expansion is even greater. The measure of the foot should therefore be taken when the weight of the body rests upon it. In winter, both sexes should only use boots provided with thick soles.

Females are often insufficiently clothed. In winter, the gossamer-like ball-room costume, which leaves the most vital regions of the body exposed, is the cause of many maladies. The excessively small bonnets now worn answer very well in summer, but during cold weather they afford very little protection to the head and neck, and are probably a common cause of neuralgia and of rheumatism. Heavy ornaments on the head are injurious; and the prevalent fashion of wearing enormous pads of false hair, to augment the natural size of the *chignon*, is objectionable for several reasons.

Stays laced tightly are most dangerous in the case of girls not fully grown, because the pressure prevents the proper development of the chest, and indeed seriously modifies the anatomy of the whole trunk. The compression of the waist contracts the volume of the lower part of the lungs; the diaphragm, or membrane that separates the chest from the stomach, is pushed up higher into the chest, the shoulder blades are forced back upon the spine, and the size of the stomach is diminished. The results of these serious malformations are diminished breathing power and impaired digestion. The German physiologist, Soemmering, has enumerated no fewer than ninety-two diseases resulting from tight lacing. The practice of tight lacing is not nearly so prevalent now as formerly; probably because it has been discovered that an excessively small waist is unnatural and unbecomful. The Greek and Roman women wore their clothes suspended from the shoulders; but in modern times nearly the whole weight of the

apparel of females is sustained by a girdle placed round the waist. The modern method is, on physiological grounds, inferior to the classic mode. It causes great pressure to be applied to the muscles of the chest, the back, and the stomach, by which their development is seriously impeded, and their healthy action greatly interfered with. This malpractice—of wearing the clothes in such a way as to cause a constant pressure upon the body—produces, in a large number of cases, the most serious structural alterations in most of the important internal organs.

CHAPTER XXIV.

FOOD AND DIETARIES.

The commercial value and the nutritive value of foods are very different things. A shilling's worth of one kind of food may contain more actual nutriment than is present in a pound's worth of another variety. High-priced foods owe their value to the superiority of their flavour, and, but to a less extent, to their rarity. Amongst the ordinary foods of the people there are, however, considerable variations in their nutritive properties; and chemists and physiologists are endeavouring to determine which are the animal and vegetable substances that yield the largest amount of digestible nutriment at the smallest cost. The solution of this problem is hampered with many difficulties. We may, of course, analyse the different foods, and ascertain which of them contain the greatest quantities of albuminous matters, fats, and other alimental principles; but until we know whether or not these ingredients are capable of being assimilated, the mere percentages of albuminoids and carbo-hydrates in foods do not strictly represent their actual nutrimental value. One mode of estimating the value of food consists in determining the amount of heat which it gives off when burned. Heat is the equivalent of motive power; and, therefore, the food which evolves the most heat is best capable of supplying animal heat and motive power. It must, however, be borne in mind that unless food is completely digested and utilized in the animal economy, its full thermotic, or heat-producing power will not be rendered available. Cellulose is contained in vegetable foods, but it is indigestible; therefore, although it produces a large amount of heat when burned outside of the body, it cannot be got to burn within it. Again, the albuminous constituents of food are not, under any circumstances, completely exhausted of their *force*, or latent heat and energy, in the body; for, having been thoroughly digested, and their elements in new combinations ejected from the system, these latter still are capable of being burned. Corrections can, however, be applied in the

case of the albuminoids; and as our knowledge of the relative digestibility of the albuminoids, fats, and carbo-hydrates in different foods is by no means limited, we are enabled to make a tolerably accurate estimate of the absolute and relative values of foods by analysing them, and determining their heat-giving and force-producing power.

The following table, constructed by Dr. Letheby, exhibits the chemical composition of the more important foods, according to the most recent analyses:—

	WATER.	ALBUMIN, &c.	STARCH, &c.	SUGAR.	FAT.	SALTS.	TOTAL PER CENT.		Carbonaceous to one Nitrogenous.	TOTAL PER CENT.	
							Nitrogenous.	as Starch.		Nitrogen.	Available Carbon.
Bread	37	8.1	47.4	3.6	1.6	2.3	8.1	55.00	68	1.25	28.21
Wheat flour	15	10.8	66.3	4.2	2.0	1.7	10.8	75.50	7.0	1.66	88.57
Barley meal	1	6.3	69.4	4.9	2.4	2.0	6.3	80.30	12.8	0.97	36.61
Oatmeal	15	12.6	58.4	5.4	5.6	3.0	12.6	77.80	6.2	1.94	40.44
Rye meal.	15	8.0	69.5	3.7	2.0	1.8	8.0	78.20	9.8	1.23	38.48
Indian meal	14	11.1	64.7	0.4	8.1	1.7	11.1	85.35	7.7	1.71	43.09
Rice	13	6.3	79.1	0.4	0.7	0.5	6.3	81.25	12.9	0.97	39.03
Peas	15	23.0	55.4	2.0	2.1	2.5	23.0	62.65	2.7	3.54	38.55
Arrowroot	18	—	82.0	—	—	—	—	82.00	—	—	36.44
Potatoes	75	2.1	18.8	3.2	0.2	0.7	2.1	22.50	10.7	0.31	10.98
Carrots	83	1.3	8.4	6.1	0.2	1.0	1.3	15.00	11.5	0.20	7.28
Parsnips	82	1.1	9.6	5.8	0.5	1.0	1.1	16.65	15.1	0.17	7.91
Turnips	91	1.2	5.1	2.1	—	0.6	1.2	7.20	6.0	0.19	3.76
Sugar	5	—	—	95.0	—	—	—	95.00	—	—	42.22
New milk	86	4.1	—	5.2	3.9	0.8	4.1	14.95	3.6	0.63	8.55
Skim milk	88	4.0	—	5.4	1.8	0.8	4.0	9.90	2.5	0.62	6.26
Buttermilk	88	4.1	—	6.4	—	—	4.1	8.15	2.0	0.63	5.53
Cheddar cheese	36	28.4	—	—	31.1	4.5	28.4	77.75	2.7	4.37	47.77
Lean beef	72	19.3	—	—	3.6	5.1	19.3	9.00	0.5	2.97	12.98
Fat beef	51	14.8	—	—	29.8	4.4	14.8	74.50	5.0	2.28	39.99
Lean mutton	72	18.3	—	—	4.9	4.8	18.3	12.25	0.7	2.82	13.95
Fat mutton	53	12.4	—	—	31.1	3.5	12.4	77.15	6.3	1.91	40.33
Veal	63	16.5	—	—	15.8	4.7	16.5	39.50	2.4	2.54	25.22
Fat pork	39	9.8	—	—	48.9	2.3	9.8	122.25	12.5	1.51	58.89
Green bacon	24	7.1	—	—	66.8	2.1	7.1	167.00	23.5	1.09	77.52
Dried bacon	15	8.8	—	—	73.3	2.9	8.8	183.25	20.8	1.36	85.53
Tripe	68	13.2	—	—	16.4	2.4	13.2	41.00	3.1	2.04	24.36
Poultry	74	21.0	—	—	3.8	1.2	21.0	9.50	0.4	3.23	13.99
White fish	78	18.1	—	—	2.9	1.0	18.1	7.25	0.4	2.79	11.64
Eels	75	9.9	—	—	13.8	1.3	9.9	34.50	3.5	1.53	19.93
Salmon	77	16.1	—	—	5.5	1.4	16.1	13.75	0.8	2.48	13.60
Entire egg	74	14.0	—	—	10.5	1.5	14.0	26.25	1.9	2.16	18.18
Butter and fats	15	—	—	—	83.0	2.0	—	207.50	—	—	92.22
Beer and porter	91	0.1	—	8.7	—	0.2	0.1	8.70	87.0	0.02	3.92

The available carbon consists of all the carbon of the carbonaceous constituents of the food, and of the carbon of the nitrogenous matter after deducting the carbon of the urea which is excreted, 100 parts of dry nitrogenous matter yielding 31.23 urea.

The amount of heat that raises the temperature of one pound of water 1 deg. Fah. is equivalent to the mechanical power or force that raises 772 lbs. one foot high, or one pound through a height of 772 feet. Frankland has determined the amount of force which different foods evolve when burned, and (by calculation) that produced when they are completely utilised in the body. Some of the more important of these results are given in the following table:—

MECHANICAL POWER OBTAINED BY BURNING 10 GRAINS OF DIFFERENT KINDS OF FOOD IN OXYGEN, AND BY THEIR OXIDATION IN THE BODY.

Name of Food.	Per cent. of Water in Material.	Lbs. lifted 1 foot high.	
		When Burnt in Oxygen.	When Oxidised in the Body.
Butter ...	15	14,421	14,421
Cheshire cheese ...	24	9225	8649
Oatmeal ...	15	7952	7800
Wheat flour ...	15	7813	7623
Pea-meal ...	15	7813	7487
Arrow-root ...	18	7766	7766
Ground rice ...	13	7566	7454
Yolk of egg ...	47	6809	6559
Lump sugar ...	19	6649	6649
Grape sugar ...	20	6510	6510
Entire egg (boiled) ...	62	4732	4526
Bread crumb ...	44	4431	4263
Ham (boiled) ...	54	3929	3321
Mackerel ...	71	3551	3200
Lean beef ...	71	3111	2829
Lean veal ...	71	2609	2324
Guinness's stout ...	88	2138	2138
Potatoes ...	73	2007	1977
Whiting ...	80	1791	1569
Bass's ale ...	88	1536	1536
White of egg ...	86	1328	1143
Milk ...	87	1312	1246
Carrots ...	86	1050	1031
Cabbage ...	89	864	834

To raise 1,000,000 lbs. a foot high is an extremely hard day's work for a strong man; yet the force necessary for the accomplishment of this labour is stored up in 700 grains, or somewhat less than $1\frac{1}{2}$ ounces of butter. Heat and motive power are wasted when applied by means of mechanical contrivances. Not a tenth part of the heat generated beneath the boiler of a locomotive is converted into available mechanical energy. The animal mechanism contrived by divine wisdom is that in which heat and force are

most completely economised, yet even in it there is some waste of energy, and especially of the materials from which it is evolved. It is found that, practically, food yields only about one-half of the force which, according to theory, it actually contains. The internal movements of the body—such as respiration and the heart's action—are sustained by the combustion of food (or of the blood and tissues into which it is converted), and in the case of an adult man are daily maintained by a force competent to raise about 600,000 lbs. a foot high. A man whose daily work is equivalent to the raising of 400,000 lbs. a foot high will, therefore, use 6-10ths of the force evolved by his food in merely sustaining the vital functions of his body. The amount of energy necessary to sustain a man for twenty-four hours is equal to the force set free by the combustion of each of the following quantities of food:—

Food.			Ounces.
Cabbage	...	...	31·0
Carrots	...	...	25·6
Milk	...	...	21·2
Potatoes	...	...	13·4
Lean veal	...	...	11·4
Lean beef	...	...	9·3
Lean ham	...	...	7·9
Lump sugar	...	...	3·9
Flour ...	...	...	3·5
Peameal	...	...	3·5
Oatmeal	...	...	3·4
Butter	...	...	1·8

Liebig, many years ago, divided foods into two great classes—the nitrogenous, or flesh-forming principles, and the non-nitrogenous, or fat-forming and heat-giving principles. The nitrogenous matters repair the muscles, which, undergoing incessant changes, are the source of animal motive power, or energy. The non-nitrogenous serve to form fat, which, when oxidized, or slowly burned, produces the heat which maintains the temperature of the body. The results of the experiments of Voit, Mayer, Fick, Wislicenus, E. Smith, Parkes, Frankland, Haughton, and others, lead to the conclusion that the non-nitrogenous portion of our food is the chief source of muscular force. It would appear that during activity the muscles grow rather than waste, but after exertion there is a slightly increased excretion of nitrogen from them. As the great bulk of our food is made up of non-nitrogenous matter, which is also in general the most digestible, it is evident that upon it chiefly depends the production of both heat and energy within our bodies. Whether or not the food must be converted into blood, muscle, or fat before it is available for the production of heat and energy is still a vexed question. It is most probable that the food is converted into blood, or in some way intimately incorporated with that fluid; otherwise it is difficult to conceive how the force it contains could be applied to the purposes of the body.

Notwithstanding the valuable researches which have recently been made relative to this subject, I believe that it is still veiled in great obscurity. It is, however, very probable that a large proportion of the motive power evolved within the animal mechanism is derivable from the disorganisation of the carbo-hydrates and fats of food, or of the tissue into which they are converted. Still, we can easily conceive that if the non-nitrogenous elements of food be deficient, whilst the albuminoids are largely in excess, the animal motive power and the animal heat will be chiefly derived from the latter. If albumin be consumed as food, and its elements pass away from the body in the almost purely mineralised form of urea, there can be no doubt of its contributing to maintain the heat or motion (and probably both) of the body. My own *opinion* is that every kind of food evolves both heat and motive power in the animal body. Savory found that rats could live on a diet from which the so-called fat-producing foods had been utterly excluded. The celebrated experiment of Fick and Wislicenus—the ascent of the Faulhorn, and its results—which has to some extent been the means of directing general attention to this point, appears to be open to criticism. They found that the expenditure of force necessary to raise their bodies through a certain height must have been nearly altogether derived from the consumption of the non-nitrogenous constituents of their food or bodies. The quantity of nitrogenous food or tissue used was estimated by the amount of nitrogen found in the urine. Now, E. Smith has shown that the elimination of urea does not increase *during* active exercise, but *after* it; and it does not appear that allowance was made for this fact by Fick and Wislicenus. Again, they estimated the force employed to raise their bodies to the summit of the Faulhorn as if they had been elevated through perpendicular height, instead of raised up an inclined plane. To ascend a mountain at an angle of 45 degrees requires a much greater expenditure of *energy* than would be necessary if it were climbed at an angle of 25 degrees. It is probable that the work performed by Fick and Wislicenus was over-estimated by at least one-fourth, and, consequently, they under-estimated the amount of motive power obtained by the consumption of their nitrogenous tissues or food. It is, however, evident from the results of the researches of Voit, Bischoff, Frankland, Haughton, Mayer, and others, that, under ordinary circumstances, increased exercise causes an increased expenditure rather of the fats and carbo-hydrates than of the albuminoids.

The great majority of the people of the upper and middle classes introduce more food into their bodies than is necessary for the purpose of nutrition; and they are, consequently, the greatest sufferers from dyspepsia, obesity, plethora, and similar diseases arising out of over-nutrition. On the other hand, a large proportion of the population subsist on a diet which barely serves to sustain the motions of their bodies. Lastly, there is a small proportion of the population who do not receive sufficient food where-

with adequately to repair the inevitable waste of their bodies. These unfortunates exist in every stage of starvation. Some are actually dying rapidly for want of food; others are perishing slowly, but surely, from insufficient aliment; many barely succeed in keeping their miserable and wasted bodies alive. The greatest sufferers from defective nutrition are young children, of whom many thousands annually perish in the United Kingdom for want of proper nourishment.

According to the researches of E. Smith, an adult man cannot exist unless supplied daily with food containing 4,100 grains of carbon and 190 grains of nitrogen. Two pounds of bread furnish this amount of carbon; but it requires $2\frac{1}{4}$ lbs. of bread to provide the nitrogen. $2\frac{1}{4}$ lbs. of bread per day constitute a famine diet for a man, and $1\frac{3}{4}$ lbs. of bread a famine diet for a woman.

From a careful study of the researches of Voit, Pettenkofer, E. Smith, and other investigators, I have come to the conclusion that an adult requires daily per 100 lbs. of his weight the following *minimum* quantities of food principles:—

	Ounces.
Nitrogenous substance	$1\frac{1}{2}$
Fats	$\frac{1}{4}$
Starch, or other carbo-hydrate	9
Saline matter	$\frac{1}{2}$
	<hr/>
	$11\frac{1}{4}$

According to Moleschott, a working man of average height and weight requires daily—

	Ounces, Avoirdupois.
Albuminous, or flesh-forming substances ...	4·587
Fatty bodies	2·964
Carbo-hydrates (starch, sugar, &c.)	14·267
Salts	1·048
	<hr/>
	22·866
Water	<hr/>
	98·580
	<hr/>
	121·446

According to Lyon Playfair, 3 ozs. of flesh-formers, $\frac{1}{2}$ oz. of fat, and 12 ozs. of carbo-hydrates are the *minimum* quantities on which an adult can exist.

The following table shows the dietaries of work people poorly or barely fed, according to E. Smith's calculations:—

Class of Labourer.	Bread & Stuffs.	Potatoes.	Sugars.	Fats.	Meat.	Milk.	Cheese.	Tea.	Containing		Cost.
									Carbon.	Nitrogen.	
	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Ozs.	Grains.	Grs.	s. d.
Needlewomen (London) ...	124.0	40.0	7.3	4.5	16.3	7.0	0.5	1.3	22,900	950	2 7
Silk weavers (Coventry) ...	166.5	33.7	8.5	3.6	5.3	11.6	1.0	0.3	27,028	1104	1 11½
Silk weavers (London) ...	158.4	43.8	8.8	5.5	11.9	4.3	0.3	0.6	48,288	1165	2 8½
Silk weavers (Macclesfield) ...	138.8	26.6	6.3	3.4	3.2	41.9	0.9	0.3	27,346	1177	1 8½
Kid gloves (Yeovil) ...	140.0	84.0	4.3	7.1	18.3	18.3	10.0	0.9	28,623	1213	2 9½
Cotton spinners (Lancashire) ...	161.8	22.6	14.0	3.1	5.0	11.8	0.7	0.7	29,214	1295	2 3
Hose weavers (Derbyshire) ..	190.4	64.0	11.0	3.9	11.9	25.0	2.2	0.4	33,537	1316	2 6½
Shoemakers (Coventry) ..	179.8	56.0	10.0	5.8	15.8	18.0	3.3	0.8	31,700	1332	2 7½
Farm labourer (England) ..	196.0	96.0	7.4	5.5	16.0	32.0	5.5	0.5	40,673	1594	3 0
Farm labourer (Wales) ...	224.0	138.7	7.5	5.9	10.0	85.0	9.8	0.5	48,354	2031	3 5½
Farm labourer (Scotland) ..	204.0	201.0	5.8	4.0	10.3	124.8	2.5	0.7	48,980	2348	3 3½
Farm labourer (Ireland) ...	326.4	92.0	4.8	1.3	4.5	135.0	—	0.3	48,366	2434	1 9½
Mean of all ...	184.2	78.1	8.0	4.5	10.7	42.9	3.1	0.6	34,167	1500	2 7½
Average per day ...	26.3	11.1	1.4	0.6	1.5	6.1	0.4	0.1	4,881	214	0 4½

Pettenkofer and Voit state that a proper dietary for soldiers should include 5·2 ounces of dry albuminous substances, 3·63 ounces of fat, and 13·3 ounces of carbo-hydrates. According to Playfair, the diet of British soldiers contains—Flesh-formers, 4·230 ounces; fat, 1·665 ozs.; carbo-hydrates, 18·541 ozs.; mineral matter, 0·789. Total, 25·245. According to Dr. Parkes, the French soldier receives 4·31 ounces of flesh-formers, 1·328 of fat, and 18·212 of starch, sugar, and other carbo-hydrates.

The diet of the British soldier on home service consists of:—Meat, 12 ozs.; bread, 24 ozs.; potatoes, 16 ozs.; other vegetables, 8 ozs.; coffee, ·33 ozs.; tea, ·16 ozs.; sugar, 1·33 ozs.; milk, 3·25 ozs.; salt, ·25 ozs.: total, 65·32 ozs.; costing, according to the state of the markets, from 7d. to 9d. Military prisoners at hard labour receive from 8 to 10 ozs. of oatmeal, 9 to 12 ozs. of Indian meal, 8 ozs. of bread, and 24 ozs. of milk.

It has often been said of the Irish small farmers and agricultural labourers that their food is relatively deficient in nitrogenous matters; but Dr. Smith shows that it contains 25 per cent. more nitrogen than is supplied by the diet of the English agricultural labourer. Dr. Smith also states that the Irish eat less potato than the English, and not half the amount consumed by the Scotch. Dr. Smith's statistics were collected since the potato famine, and at a time when Indian meal and oatmeal were largely used in Ireland; but during late years the potato is rapidly supplanting the Indian meal and oatmeal, and, therefore, new statistics relative to the food of the Irish peasantry are required. When the Irish small farmer subsisted upon an exclusively potato and buttermilk diet, he consumed (as I find by careful inquiries)¹ 14 lbs. of potatoes and 3 (16 ounces) pints of buttermilk per day. This would give him—allowing 24 oz. for waste, skins, &c.—200 oz. of potatoes and 48 oz. of buttermilk per diem, or at the weekly rate of 42 oz. of albuminates, 210 oz. of starch, 56 oz. of sugar, and 3½ oz. of fat. These figures show that in albuminates and carbo-hydrates the diet of the Irish peasant was superior to that of the agricultural labourers of England and Scotland, and even to that of soldiers and sailors. They also show that there was a proper proportion between the albuminates and carbo-hydrates. The striking defect of the diet was its very small amount of fat; its great bulk, too, was not a recommendation. This diet is still in use, but rarely; oatmeal, Indian meal, and flour being very generally employed throughout the country.

The dietaries of well-fed operatives, calculated by Lyon Playfair, are shown in the following table:—

¹ 2,000 circulars kindly sent out for me by the proprietor of the *Farmers' Gazette* and enclosed in that journal.

QUANTITIES OF FOOD CONSUMED WEEKLY BY OPERATIVES.

	Albuminous Matters. Ounces.	Fats. Ounces.	Starch and Sugar. Ounces.	Carbon. Grains.	Nitrogen. Grains.
Fully-fed tailors ...	32.97	9.57	129.29	35.952	2.275
English sailor ..	35.00	17.99	100.73	23.838	1.764
French sailor ..	40.18	9.24	166.20	44.653	2.835
English navvy ...	60.18	26.74	194.67	58.065	3.374
Blacksmith ...	44.40	17.50	186.50	48.048	3.059

Women require about 10 per cent. less food than men of the same weight; but as the bodies of children are growing, they require more food in relation to their weight and labour than adults. In calculations, $2\frac{1}{2}$ lbs. of carbo-hydrates (sugar, starch, &c.) are only equal to 1 part of fat. Due allowance must be made for the cellulose, and other well-known indigestible substances, present in some foods.

There is greater simplicity in the cookery of these countries than in the *cuisine* of our French and some other continental neighbours. The true Briton still loves the *blood red* joint which found such favour in the eyes, or rather mouth, of his medieval ancestor; whilst the Frenchman's meat is so thoroughly cooked and seasoned that it is almost impossible to know the nature of the animal that furnished it. On the whole, I think the English do not sufficiently cook their joints, whilst, perhaps, the French go a little too far towards the other extreme. Of late years the cookery systems of the two countries have been somewhat reacting upon each other—no doubt to their mutual advantage. In the matter of economy, the *cuisine* of the middle and lower classes in France is decidedly superior to the methods of cooking adopted by the corresponding classes of society in Great Britain. The French buy their meat every day, and serve it up in the form of soups, ragouts, and various highly seasoned dishes. In this way they can indulge in hot dinners every day. On the other hand, the British well-paid artisan, clerk, and even professional man is obliged to dine too frequently on cold meat, because the purveyor of his household adheres to the national custom of purchasing joints or other large pieces of meat. There is occasionally waste, too, incurred by buying large joints; for although the dreaded "cold shoulder" of mutton may be cheerfully endured the day after it had been discussed hot and juicy, still few—not even the most economical *pater familiæ*—would like a third visitation from the same joint. If the French system were suddenly to supplant the time-honoured cooking institutions of these countries, I fear that the cooks would be serious sufferers, for in France their fatty perquisites are very small indeed. The French are just as particular in dressing their vegetables as in preparing their meat; and they have very ingenious and economical methods of incorporating both classes of food into composite dishes of excellent flavour. In Ireland meat is not quite so generally made use of in the very underdone condition in which it is served up in England. The Scotch, too, appear to

cook their meat more thoroughly, and they somewhat resemble the French in the variety of their "made" dishes. In Paris the very best meat is sold in very small quantities; but in the large towns of the United Kingdom it is difficult to purchase beef or mutton of the best quality unless in large quantities.

The most economical way to use meat is to cook it in hot water, and eat it served up in its own gravy. If meat be boiled for the purpose of forming soup, the water should not be abruptly raised to the boiling point; for otherwise the albuminous matters speedily coagulate, and prevent the juices of the meat from passing into the water. The meat should be chopped or cut as fine as possible, steeped for some time in cold water, and then the latter may be gradually heated up to a temperature not exceeding 140 degrees Fahrenheit, or 72 degrees lower than the boiling point of water. At the last moment the temperature of the soup may be allowed to reach the boiling point. Bones require to be boiled, or rather *simmered*, for eight or ten hours, in order fully to extract their nutritive matter. They should be thoroughly crushed. When the meat is to be used with the soup formed from it, the boiling need not be so prolonged as to render the flesh insipid.

Soup contains the greater part of the saline matter, the crystalline principles (*creatin*, *creatinin*, &c.), some of the albumin and fat, and an amount of gelatin, dependant upon the duration of the boiling process. Nearly all the odorous matters contained in the meat are transferred to the soup. Cold water extracts from one-sixth to one-fourth of the weight of the solid ingredients of meat; and in this watery extract the savoury, saline, and crystalline ingredients are very abundant. After long continued boiling, meat becomes a hard mass, composed of horn-like, muscular fibres, the (*areolar*) tissue connecting them, and parts of the nerves and blood vessels. It is almost impossible to masticate it; it is nearly perfectly indigestible; and it is so devoid of flavour that it is impossible to know from its properties the nature of the animal that furnished it. Even a dog, as Liebig says, will reject it.

E. Smith, in his excellent work on Practical Dietaries, gives several good receipts for soup for the working classes, of which the following are two examples:—*Soup for 100 persons*.—"Meat liquor from 7 lbs. of beef and 1 lb. of bones; split peas, 13 lbs.; carrots and swede turnips (of each), $6\frac{2}{3}$ lbs.; onions, $5\frac{1}{2}$ lbs.; leeks, $\frac{1}{2}$ lb.; salt, pepper, and herbs." These materials would require 12 gallons of water. *Broth for 100 persons*.—"Meat liquor from 7 lbs. of beef and 1 lb. of well broken bones; split peas ($1\frac{1}{3}$ d. per lb.), $2\frac{3}{4}$ lbs.; Scotch barley ($1\frac{1}{3}$ d. per lb.), 3 1-5th lbs.; carrots ($\frac{1}{4}$ d. per lb.), $3\frac{1}{2}$ lbs.; turnips ($\frac{1}{8}$ d. per lb.), $3\frac{1}{2}$ lbs.; cabbage and other green vegetables, $7\frac{1}{4}$ lbs.; salt, pepper, and dried herbs."

For invalids, beef soup is by far the best. That made from mutton is less digestible, and is seldom free from fatty matter. Veal (which forms the "stock" of white soups) does not form a good soup for the sick. The presence of a large quantity of highly

nitrogenous crystalline principles in soup accounts for its wonderful restorative powers. Very strong beef tea might almost be classed with such stimulants as brandy and tea. Creatin, creatinin, and other similar bodies in meat bear a close resemblance to the thein of tea and coffee and the theobromin of cocoa. The best form in which animal food can be given to children is, perhaps, as beef soup, or tea.

If we wish to cook meat in such a way as to preserve, as much as possible, its nutritious properties and its digestibility, we should proceed as follows:—The meat is placed, in one or more *large* pieces, in boiling water, and kept there for five minutes. The high heat coagulates, or clots the albumin at the surface of the meat, stops up its pores, so to speak, and thereby prevents, to a great extent, the juices of the meat from leaving it. The boiling is continued for about five minutes, and then cold water is added, so as to reduce the temperature to about 150 degs. Fahr., and the cooking process goes on at that degree of heat until the meat is done. Meat that is cooked altogether at the boiling point is generally tough. By boiling, meat loses from 20 to 35 per cent. of its weight—the average for beef being about 25 per cent., and for mutton a little more. Salted meat intended to be eaten cold should be allowed to cool in the water in which it has been boiled.

In roasting meat the object should be to apply the heat so suddenly as, to immediately coagulate the albumin at the surface, just as I have described should be done in boiling meat. The meat is at first placed close to the fire, kept there for about ten or fifteen minutes, and then withdrawn to a greater distance from the heat. It should be roasted very slowly, so that the inner parts may be perfectly done. The loss of weight—nearly altogether water and fat—in roasting is greater by nearly one-third than that sustained by boiling. Aromatic materials are developed by roasting, which are very grateful to the sense of smell; and this form of cooking certainly produces the most agreeably flavoured food. The occasional addition of flour to the surface (*dredging*) stops up the pores, and restrains the too rapid escape of the fats. Roasted meat is not so well adapted as boiled meat for sick and delicate persons, as it is apt to contain acrid substances formed out of the highly heated fats. Broiling is a species of roasting, but it produces in general a somewhat more digestible food for the dyspeptic.

Baking is sometimes found a convenient mode of cooking meat; but the dishes prepared by that process often have a rank flavour, which renders them inadmissible in the case of the sick and dyspeptic. Improved ovens for baking meat are coming into use; they have ventilating openings through which the volatile matters discharged from the dishes are got rid of: the flavour of the meat baked in this way is not so rank. Fried meat is, perhaps, the worst form in which this food could be given to the sick, as it almost invariably contains a most acrid substance, termed *acrolein*,

and various unpleasant fatty acids. Stews and hashes are generally very savoury, but they seldom agree with people of weak digestion. When made from fresh meat they are infinitely superior to the dishes made of re-cooked meat. The repeated cooking of any kind of food greatly injures its nutritive properties; for this reason it is better to re-heat our good cold beef and mutton in our stomachs rather than in our frying-pans or stewing pots.

The only drawback to the cooking of meat at a low temperature is the danger that it may contain trichinæ or other parasites capable of existing at a temperature of 140 degs. If, however, the meat be cooked until all traces of redness have disappeared, it is extremely unlikely that it would still contain living animals. Meat may be cooked at a high temperature, and still remain underdone; whilst, even at a heat of 140 degs., it may be too much done. The thorough cooking of foods depends more upon the duration of the process than upon the temperature to which they are exposed. Salted meat is not so nutritious as the fresh article, because much of its saline constituents pass off in the brine. Scurvy is produced by the continued use of salted meat without fresh vegetables.

The proper food for the newly-born infant is the milk of its mother. This nutriment should not be withheld, except for very sufficient reasons, and in obedience only to the strict orders of the physician. If the mother's milk be not available, the best substitute for it is that provided by a healthy "wet" nurse. Thousands of infants are satisfactorily fed from their birth upon a diet altogether destitute of human milk; but those children usually possess strong vital powers. It is the infants who are naturally delicate, or puny, who most suffer from the want of the nourishment intended by nature for their use.

The diet of the wet nurse should be abundant, nutritious, and plain. Persons in that position of life are not accustomed to dainties, and, therefore, any very marked change in their diet is more likely to prove injurious than beneficial. The vulgar idea that a wet nurse could hardly drink too much porter is a most erroneous one. She should be altogether prohibited from taking ardent spirits, or even wine, and her supplies of malt liquor should be limited to two small bottles a day as a *maximum* quantity. Of good milk she could hardly drink too much, and she should be supplied with abundance of plain animal food. Of tea or coffee she should partake sparingly, and these beverages should be rather weak.

Those ladies who are able to nurse their infants should use a generous diet, and more especially should they drink plenty of good milk, if they can get it—for in towns that liquid is almost invariably adulterated with water. With respect to alcoholic liquors, I am inclined to think that nursing mothers are rather too liberal in using them—not from actual fondness for them, but because they believe them to be necessary adjuncts to their ordinary diet. There are delicate nursing mothers who are unable to consume

sufficient food wherewith to supply their own wants and those of their infants. Those mothers are often undoubtedly benefited by a liberal allowance of malt liquors, which they are able to digest, and which, to a great extent, perform the functions of food.

In the absence of human milk, that of the cow or the ass should be used—the former diluted with one-third of its volume of water, and slightly sweetened. The milk of the goat is more liable to coagulate than that of the cow or ass, and it should not, therefore, be given to very young infants. As saliva of infants contains little or no ptyalin, it is, therefore, incapable of converting starchy food into dextrin and sugar.

Some children are confined to a milk diet until they are a year old; but there does not appear to be any merit in this practice. After two months it will, with few exceptions, be found advantageous to give something in addition to milk, either rusks (in the form of *panado*), or preferably one of the foods prepared specially for the use of infants. I am strongly of opinion that infants at three months old would be benefited by the use, in very moderate quantity, of weak beef tea or chicken broth. These foods, if necessary, may be given from the feeding bottle. Feeding children from a bottle provided with an artificial teat is now very general; but it often fails in the case of sickly and feeble infants. It often fails, too, in the cases of healthy children, because the bottle and its appendages are not kept sweet and clean. Whilst one bottle is in use another should be steeping in water.

Human milk has a temperature of about 100 degs., therefore it is obvious that the milk of the cow when given to infants should be warmed to from 98 degs. to 100 degs. Fahrenheit. The fresher the milk is the better; when it becomes even faintly sour it should be rejected.

Boys and girls require to be fed more frequently than adults. They are seldom capricious, and plain food in abundance is all they require. They should not use alcohol in any form, nor do they require tea or coffee until they are well grown up. Children, however, as well as adults, suffer from a want of variety in their diet. The health of the boys at the Duke of York's school was improved by introducing a greater variety into the methods of cooking their food. The sameness which at one time characterised the rations of British soldiers had a most injurious effect upon the health of the men.

As a general rule, working men appear to be quite satisfied with three ample meals a day. Breakfast should be taken early, because after a night's rest the stomach is usually without a particle of food. The French workmen make a great mistake in delaying their first substantial meal until noon. A cup of coffee and a morsel of bread do not afford sufficient force-producing materials wherewith to perform nearly half a day's work. Long walks before breakfast should not be taken; for, after a fast prolonged exercise unduly lowers the vital powers. If breakfast be taken at nine

o'clock, a.m., then dinner should not be delayed later than three o'clock. Those who cannot dine until five or six o'clock should take luncheon about one or two o'clock. Nothing can be said in favour, but much might be alleged against, the fashionable practice of dining at half-past seven, and even eight o'clock. When dinner is taken early, the evening tea should be a somewhat substantial repast. Suppers, unless of the very lightest description, should not be eaten by those who have dined heartily. In any case they should not be taken later than two hours before bed time. A good breakfast invigorates us; but a heavy, late supper depresses our vital powers. The stomach sympathises with the brain: witness the horrid nocturnal visitants conjured by our disordered imaginations under the influence of late suppers of devilled kidneys or richly dressed lobster! It would appear as if the brain, indignant at the outrages offered to the stomach, punished the *gourmand* by unpleasant dreams and terrific visions.

According to E. Smith, the dinner of the working man should contain about 25 per cent. more nourishment than his breakfast, and twice as much actual nutriment as his supper. Amongst the richer classes, the dinner contains at least as much actual nutriment as all the other meals combined.

Regularity in the hours of meals is a prime point in dietetics. To dine one day at five o'clock, the next day at six o'clock, and the following day two hours earlier is a practice which could hardly be sufficiently condemned. Periodicity is a great law of the universe. Our habits should, as far as possible, be brought into harmony with this law. We should rise, breakfast, dine, sup, and go to bed at regular stated hours. We need not, of course, carry such a system to an extreme degree; but, as a general rule, regularity in habits of living exercises a most beneficial effect upon the health. Violent exercise, or a bath, after a full meal is undesirable. Rest promotes digestion. After a long fast, food should be very slowly eaten; indeed, under any circumstances, we should not eat hastily. The craving for food is not instantly allayed by the introduction of it into the stomach; hence, if a meal be swallowed in a few minutes, more food may be consumed than is actually required. A full meal requires from three to five hours for its complete digestion; and as the stomach, like all the other organs of the body, requires rest, one meal should not be taken until an hour or so after the previous meal has probably been digested.

Somewhat less food is required in summer than in winter; for, during the former season, there is less difficulty in maintaining the temperature of the body.

A high temperature is a necessary condition in digestion. Solid fats remain long in the stomach before they are broken up; but if liquefied, they yield far more readily to the action of the digestive juices. For this and other reasons food is best taken in a warm

state. In very warm weather this rule may be relaxed, especially in the case of liquid foods. On the other hand, food too highly heated is apt to produce a bad effect upon the teeth, and may even injure the stomach. A fondness for very hot liquids is a vitiated taste; and it should be noted that it is almost impossible to appreciate the fine flavour of food, liquid or solid, if it is so hot as almost to scald or burn the mouth.

The rapidity with which food is digested depends upon various and varying conditions, such as the nature of the food, the kind of preparation to which it is subjected, the condition of the different organs of digestion, the quantity and the quality of the different digestive juices, and so on. It is, however, desirable to know, in a general way at least, which foods are the most likely to be digested quickly, other conditions being alike. For our knowledge on this point we are chiefly indebted to Beaumont, as he was the first to make experiments under conditions which were certain to afford satisfactory results. The object of his experiments was a man who had received a wound leading into his stomach, and which, healing imperfectly, left an opening through which the processes going on in his stomach could actually be looked at. Beaumont made a set of experiments with the object of ascertaining the length of time necessary to digest different foods in the stomach of this man, and another set of experiments to ascertain the time occupied in digesting food in solutions (heated to 100 degrees) of gastric juice placed in phials. The relative results of both sets of experiments were found to pretty closely coincide; and they have, on the whole, been confirmed by the results of similar enquiries undertaken subsequently by other physiologists. In the following table some of the more important results of Beaumont's experiments are given:—

		Mean time of Chymification in Stomach.	
Foods.	Preparation.	Hours.	Min.
Rice ...	Boiled ...	1	
Eggs, whipped ...	Raw ...	1	30
Trout, salmon, fresh	Boiled ...	1	30
Venison steak ...	Broiled ...	1	35
Sago ...	Boiled ...	1	45
Milk ...	Boiled ...	2	
Eggs, fresh ...	Raw ...	2	
Milk ...	Raw ...	2	15
Turkey ...	Boiled ...	2	25
Gelatin ...	Boiled ...	2	30
Goose, wild ...	Roasted ...	2	30
Pig, suckling ...	Roasted ...	2	30
Lamb, fresh ...	Broiled ...	2	30
Beans, pod ...	Boiled ...	2	30
Potatoes, Irish ...	Roasted ...	2	30
Chicken ...	Fricassed ...	2	45
Oysters, fresh ...	Raw ...	2	55
Eggs, fresh ...	Soft boiled ...	3	

Foods.	Preparation.	Meantime of Chymification in Stomach.	
		Hours.	Min.
Beef, lean, rare ...	Roasted ...	3	
Mutton, fresh ...	Boiled ...	3	
Bread, corn ...	Baked ...	3	15
Butter ...	Melted ...	3	30
Cheese, old, strong	Raw ...	3	30
Potatoes, Irish ...	Boiled ...	3	30
Beef ...	Fried ...	4	
Veal, fresh ...	Broiled ...	4	
Fowls, domestic ...	Roasted ...	4	
Ducks, domestic ...	Roasted ...	4	
Veal, fresh ...	Fried ...	4	30
Pork, fat and lean ...	Roasted ...	5	15
Cabbage ...	Boiled ...	4	30

We learn from those who have made the phenomena of digestion special studies the following general principles:—1st. That animal food is retained longer in the stomach and is more perfectly digested than vegetable aliment. 2nd. That the digestion of vegetable food is very imperfectly performed in the stomach, the labour of the operation devolving chiefly upon the intestines. 3rd. That the denser the structure of food is, the longer does it resist the action of the gastric juice. 4th. That oily and fatty substances are the most difficult to be digested.

The upper and middle classes of society consume in general more food than is necessary for the purposes of nutrition. The excess, if it be not very great, is usually speedily eliminated unchanged, or more or less altered in composition, from the system; but occasionally it is in part retained for a considerable period, producing effects varying from a mere feeling of discomfort to serious diseases. Those who habitually indulge too freely in the pleasures of the table are peculiarly liable to derangement of the digestive organs. Excessive quantities of lean meat and of sugar appear to be more readily digested than undue amounts of fatty and starchy foods, the latter being very liable to leave—hardly altered in composition—the system. A diet composed nearly altogether of albuminates produces in a few days fever and diarrhoea. When the albuminates are continuously excessive, the liver, after a time, usually shows symptoms of disease. On the other hand, an undue proportion of fats, starch, and sugar frequently induces obesity, which, undoubtedly, may be regarded as a diseased condition of the body.

In sickness the functions of the body must be maintained, and this can be accomplished by the daily expenditure of about 2 ozs. of albuminates, 10 ozs. of starches or sugars, and 1 oz. of fats. If these quantities of food be not supplied, the vitality of the whole body is maintained for a while at the expense of a portion of it; but this wasting of tissue soon reduces the system to so low an ebb that death from sheer inanition, or exhaustion, takes place.

In diseases such as fever, where there is a high temperature of the body, the waste of tissue is most rapid. In general the food supplied to a patient should be about one-third less in quantity than the amount which he usually consumes when in health; to give larger quantities, except under very exceptional circumstances (of which his physician is the proper judge), is a great, and often dangerous, mistake. In disorders of the digestive organs, which have, in all probability, originated in excess at the table, or in the use of unwholesome food, almost complete abstinence for a day or two is generally beneficial.

Only the most digestible food should be used in the sick room. Pork and other fat animal food, veal, lamb, salted meats, the strong-flavoured fowls (duck, goose, &c.), fish, and cheese should be prohibited. Beef tea, especially if rendered more stimulative by the addition of extract of meat, has saved the lives of thousands of patients; sometimes it is, however, given *ad nauseum*. Alternations of beef tea and chicken broth are desirable; for in the dietary of the sick room variety is a most important point. Jelly, though considered innutritious by most physicians, is, I am quite satisfied, a nourishing food, and well adapted to the sick. Chicken and tender young fowl are very digestible, and should be used whenever solid food can be administered. Milk is an excellent food, but it does not agree with every one, even in a state of health. When it agrees with a patient he may be liberally supplied with it.

Vegetable foods are sparingly employed in the dietaries of the sick. Grapes may almost always be used; and when there is thirst, the juices of the orange or of the lemon, tempered with a little sugar, prove useful. Esculent vegetables should not be eaten. Bread is best taken in the form of un buttered toast, very slightly browned. Biscuits and unfermented bread are superior to fermented bread in the case of dyspeptics.

In the *Zeitschrift für Biologie* (Band. vii. Heft. I.), G. Meyer, of Oldenburg, describes the results of his investigations relative to the effect of a bread diet on man and dogs. The experiments on dogs showed that there was a great loss of nutriment when they were kept exclusively on a bread diet, as a large proportion of the albuminous constituents of the bread passed unchanged through the body. When the flour was given to the dogs in the form of cakes or dumplings, a larger portion of its constituents was assimilated than when it was eaten in the form of bread. When meat was added to the bread diet the animals were enabled to digest the latter more perfectly—that is, they extracted more nourishment from bread when it was mixed with a little meat than when it was eaten by itself.

G. Meyer considers that an exclusively bread diet in the case of man is as wasteful as he found it to be in the case of dogs. On a purely bread diet, in which the albuminates are deficient as compared with the carbo-hydrates, the body becomes more

watery, and the system is, according to Meyer, more likely to contract disease. I would suggest that this result might also be in part due to the absence of ready formed fatty matters in the bread diet, whilst fats constitute the larger proportion of an ordinary meat diet.

Meyer made the following experiments to ascertain the effect of dieting on different kinds of bread-stuffs in the case of a healthy young man. The experiment lasted four days, during which time it was found impossible to maintain the man at his full weight, apparently because he could not digest sufficient bread, although, in order to facilitate digestion, fifty grammes of butter and two litres of beer were daily allowed. The bread-stuffs employed were the Horsford-Liebig rye bread (I presume made from the "self-raising" flour), Munich rye-bread, white wheaten bread, and North German black bread (*pumpernickel*). The results of the experiment proved that the fine wheaten bread was by far the most digestible, whilst the other breads stood in the following order:—Horsford-Liebig bread, Pumpernickel, and Munich rye bread. It would thus appear that it is most economical to feed people on the best quality, or, at least, on very good kinds, of bread-stuffs.

Many experiments have been made and much has been written relative to the action of tea and coffee upon the animal economy. Some authorities state that they retard the waste of tissue, without diminishing the motions of the body; but that is not likely to be the case, for the work done by the body is proportionate to the quantity of tissue or food which is decomposed within it. According to Böcker and Lehmann, tea and coffee increase the actions of the body, yet at the same time retard tissue decomposition—a statement rather paradoxical. Dr. E. Smith believes that tea promotes the metamorphosis, or change of tissue, instead of retarding it—a view to which I subscribe. We certainly feel more disposed to activity than to quiescence after taking a cup of strong tea. It is very likely that tea and coffee cause a more perfect digestion or assimilation of food; and in this way we may account for the fact, as alleged, that tea and coffee are partial substitutes for food. If they enable us to extract more nutriment from our food than it ordinarily yields, they certainly contribute to the nutrition of our bodies.

According to Dr. E. Smith, tea acts favourably upon the skin, causing increased perspiration, whilst coffee diminishes the perspiration and produces a constipatory effect. There is no doubt but that tea stimulates and invigorates the system; and that under its cheering influences we become more animated and inspirited. If this beverage be taken in excess the imagination is excited, the heart's action is greatly increased, there is often a painful or anxious feeling experienced, and the disposition to sleep at the proper time is greatly lessened. The best effects of tea are produced by its use in moderate quantities and of moderate strength. The practice of taking very strong tea to banish sleep is a very bad

one. The best time to take tea is about from one to two hours after dinner, when it generally stimulates the flagging energies of the digestive organs. It is a grateful beverage in the morning; but it should be taken in moderation. It is not suitable at luncheon or dinner. All authorities agree that tea is best taken without milk or sugar. To the aged, tea possesses many recommendations; but in childhood neither it nor coffee is a desirable beverage. The health of very young children is often injured by the use of tea and coffee. I have noticed that persons of dark complexions are fonder of tea than those whose fair skin and hair, light eyes, and corpulent persons betray their *leuco-phlegmatic* temperament. With the latter persons it often disagrees. Gouty persons are often benefited by weak tea used without sugar. Amongst the working classes tea is undoubtedly often used to an injurious excess. In Australia it is said to produce intoxication.

The use of tea, as an ingredient of the staple meals of the day, is steadily extending amongst the lower sections of the population, whilst the afternoon (four o'clock) tea has recently become a recognised refreshment amongst the upper classes. It is, perhaps, doubtful whether the well-sweetened but poor infusion of tea and the baker's bread of indifferent quality, which now constitute the morning meal in so many of the cottages of the small farmers and agricultural labourers, are so nourishing as the breakfast of porridge and milk which they have supplanted. The substitution of such articles as tea, sugar, and baker's bread for the homely articles which formerly constituted the diet of the lowest classes in the rural districts may, however, be regarded as an indication of an improvement in their condition. Although philosophers are popularly supposed to rest satisfied with the very simplest diet, it must be admitted that the skilled artisans and the brain-workers generally long, as it were instinctively, for those kinds of foods which are highly nutritious and more or less stimulative. A labourer whose work is of so simple a nature that it involves almost nothing save the expenditure of mere motive power may thrive and be thankful on his stone and a half of potatoes and half a gallon of buttermilk; but the worker who actively employs both mind and body requires something more than mere nutriment in his food—he requires it to possess flavour, high alimentative power (*i.e.*, much nutriment in small bulk), and stimulative qualities. Too frequently the stimulative properties which may be wanting in ordinary food are made up by the addition of alcohol, and it is therefore well worthy of consideration whether or not it would be desirable to encourage a general use of tea, coffee, and even cocoa amongst the labouring classes. Intemperance is the *most* fruitful source of crime and pauperism amongst the working classes, and anything that would be likely to diminish the use of alcohol amongst them would, to take the lowest ground, certainly lessen the burdens thrown upon the ratepayers, who support the prisons and workhouses.

The experiment of giving weak tea to farm labourers instead of

beer has lately been tried in several districts in England, and apparently with successful results. The Chinese workmen who constantly sip tea are industrious and sober; but then tea is cheaper in China than beer is in England. Why not reduce the duty on tea to such an extent that the poorer classes would be induced to largely consume its cheering infusion? A tea drinker is rarely a drunkard, and if the use of this beverage became general amongst the poorer classes, I have very little doubt but that there would be a corresponding decrease in the consumption of alcohol.

In the *Comptes Rendus des Seances de l'Academie des Sciences*, No. 21, 1871, M. Robuteau describes the results of his experiments on the influence of coffee and cocoa on nutrition, and from which he arrives at the conclusion that they are not mere stimulants like alcohol, but that they directly contribute to the nourishment of tissue. A dog which was fed daily upon 20 grammes of bread, 10 grammes of fresh butter, and 10 grammes of sugar died in 29 days, obviously from defective nutrition; whilst a dog supplied with 20 grammes of cocoa, 10 grammes of sugar, and an infusion of 20 grammes of roasted coffee was alive and healthy, though thin, after 29 days. M. Robuteau states that the evil results sometimes experienced by the continued use of coffee are not felt if the coffee be properly roasted. When the coffee berries are too highly heated, an injurious substance termed *cafféone* is developed in them. I believe that a large proportion of the coffee used in Paris is prepared by subjecting the berries to a current of heated air or superheated steam. I wish that this kind of coffee were more frequently to be met with in these countries; for the infusion yielded by the semi-charred berries of the British grocer is often anything but a delectable beverage. M. Gazeau has still more recently communicated to the Academy of Sciences an account of experiments performed on himself, the results of which appeared to show that cocoa decidedly increased the action of the heart and other vital organs. He believed, however, that the benefits derived from its use are more apparent than real, and that it acted by merely stimulating the vital powers, by causing a more rapid destruction, or metamorphosis, of tissue. This is really the old theory as regards the action of both tea and coffee upon the animal economy. We can, however, hardly doubt the superiority of cocoa over coffee and tea as a merely nutritive principle, for its chemical composition shows that it is rich in fat-forming and muscle-making materials. It is well known, too, that in parts of South America cocoa constitutes a staple article of food amongst the Indian population.

In Liebig's *Annalen* for May, 1871, we find a paper on tea contributed by Wöller, in which great stress is laid upon the fact that the greater proportion of the nitrogen in tea is not in the form of theine, but in that of a protein substance resembling casein, and therefore a very nutritious food.

Alcohol is a stimulant which possesses less of the characteristics

of true food than tea or coffee ; for, whilst the latter really contain some matters which are capable of forming animal tissue, there is nothing in alcohol with which any part of the body could be nourished. At one time it was believed that food could be of no use to the animal economy, except for the formation of flesh and other tissues ; and according to that view, it would be vain to ascribe any nutritious properties to alcohol. It is now, however, very generally believed that food may be utilized in the body without being converted into any of its structures. If this view be the true one, we can readily understand that alcohol might, by being oxidized, or burned in the blood, produce animal heat, or motive power. It has been alleged that the alcohol introduced into the body is wholly thrown off from it unchanged ; but the inaccuracy of this statement has been demonstrated by the result of Thudichum and Dupre's experiments. When taken in very moderate quantities, alcohol, I have no doubt, performs two of the functions of food—namely, the production of animal heat and of force. It is, however, by far the most costly food in common use, and, except in certain forms of disease, it is clearly a very expensive luxury. I believe that, without exception, healthy persons do not require alcohol in any form ; and in the case of children, its use is seldom beneficial, and generally injurious. Small quantities of it are certainly utilized in the system ; but of the amounts usually taken at and after meals, the larger proportion subserves no useful purpose, and probably passes in great part unchanged from the body. In certain diseases, where there is rapid wasting of the body, and no capability of using sufficient food to replace the worn-out tissue, alcohol is often invaluable. Under such circumstances, it retards the wasting of tissue, because it supplies the heat and energy which otherwise would have to be supplied at the expense of portions of the body. Dr. E. Smith states that alcohol lessens the activity of the muscles which are under our control ; but that it increases the action of the involuntary muscles, such as the heart and lungs.

When patients utterly refuse the ordinary kinds of nutriment they not unfrequently are able to drink one or more of the many alcoholic beverages. In fever the action of alcohol appears to be most strikingly exhibited. Professor W. Moore informs me that twenty-seven fever patients under his care during October and November, 1870, at Sir Patrick Dun's Hospital, Dublin, were liberally supplied with alcohol in the form of whiskey, brandy, or wine (or two or all of these liquids), and that not a single death occurred amongst them ; though in many cases the disease (enteric, typhus, and simple continued fevers) was of the most severe type. In the case of chronic maladies, the use of alcohol, though sometimes beneficial, certainly produces less satisfactory results than attend its employment in inflammatory complaints. Here, in candour, it must be admitted that many eminent physicians deny the efficacy of alcohol in the treatment of any kind of disease, and some assert that it is worse than useless. The preponderance of

medical opinion is, however, in favour of the use of alcohol as a semi-medicinal, semi-nutritive substance.

Dyspepsia is a term vaguely employed to designate a somewhat ill-defined class of diseases of the digestive organs. In a limited sense it means the abnormal condition of the stomach and duodenum, in which these organs, without being structurally diseased, are incapable of perfectly and easily digesting ordinary food. The causes of simple dyspepsia, or indigestion, are numerous. Deficiency of nutriment, inferior and badly cooked food, and bad condition of the blood, are prime causes of indigestion amongst the lower classes. Undue pressure of the clothes upon the body, irregularity in the hours of meals, excessive quantities of food, imperfect mastication, severe mental and bodily exercise, great anxiety of mind, and sedentary habits, are amongst the common causes of imperfect digestion. A dyspeptic who is an idler should try active exercise as a remedy; whilst relaxation often affords immediate relief to the brain or body worker, whose labours are excessive. "One man's meat is another man's poison" is a trite but true adage. Many persons constantly eat and drink things which, though generally digestible, they well know are certain to disagree with themselves. Simply for the momentary gratification of their palate they willingly undergo hours of discomfort, if not of actual pain. Any food which disagrees with the stomach will, if constantly used, be likely to convert the occasional into the confirmed dyspeptic. Flatulence is a common form of dyspepsia. Those subjected to it are benefited by abstaining as much as possible from esculent vegetables. They should, however, use a little fruit, in order to supply the necessary saline ingredients of food, and which are most abundant in vegetables. Grapes and roasted apples are not likely to produce *flatus*.

Pyrosis, or acid dyspepsia, is a very common form of indigestion. It is produced by an excess of acid (lactic, or acetic) in the stomach. It is frequently caused by a diet in which the starchy elements of nutrition preponderate; and it is, therefore, common amongst the poor. Heartburn often results from the decomposition of butter in the stomach, whereby an intensely acrid and strong-flavoured substance, termed butyric acid, is produced. Those who suffer from acid dyspepsia should especially avoid pastry, and all dishes containing highly heated butter. They should prefer a diet in which the albuminates preponderate rather than the carbohydrates. A bulky diet seldom agrees with the sufferer from acid dyspepsia.

Biliousness is an abnormal condition of the system which some persons believe is induced by an excessive development of the bile, whilst others suppose that it is caused by the inactivity of the liver. In general the liver has very little to do with the state popularly termed bilious, the malady being frequently caused by fermentation of food in the stomach, either from deficiency of gastric juice or from the overloading of the organ. Sometimes

the duodenum becomes obstructed, and the food, after partial digestion in the stomach, cannot descend into the former viscus; under such circumstances the food in the stomach becomes semi-putrid, and produces nausea, headache, and even worse symptoms. Occasionally the duodenum, when obstructed at its lower end, discharges bile into the stomach. Certain kinds of food, which cannot, owing to individual idiosyncrasies, be readily digested, undergo partial putrefaction in the stomach, and produce bilious symptoms. Active exertion, regular habits, and moderate diet are the best remedies for simple biliousness.

In dyspepsia, pure and simple, where there is no organic disease, change of air and scene often works wonders. Those who suffer from indigestion usually say that their stomachs are out of order—a perfectly true statement; but in a large proportion of cases the nervous system is out of order and the blood is impure. It is as much by its effects upon the blood and nervous system as by its influence upon the stomach that a sojourn in some of the health resorts of Great Britain and the Continent does good. Wonderful a machine as the stomach is, it cannot do its work without the aid of the nervous system; and if the brain and spinal chord are exhausted by overwork of any kind, they are unable to devote to the service of the digestive organs the necessary amount of force wherewith adequately to sustain the functions of the latter. The country gentleman well knows how soon his horse would get knocked up if permitted to take a full feed after a hard day's work with the hounds; and many a dyspeptic owes much of his misery to his sitting down to dinner thoroughly worn out by the brain worry and physical fatigue of the day. All who breathe impure air and have languid respiration are prone to have their blood loaded with impurities; and those unhealthy conditions of existence lead in many ways to indigestion. Taking all these matters into account, the dyspeptic, about to take his holiday trip, should select some place which will at once afford rest for the mind and objects to gratify his eye—something to constantly engage his attention, and, above all, something which will induce him to take plenty of exercise in good air. Most of the places in Ireland which fulfil these conditions are on or near the coast—Lisdoonvarna, Bundoran, Portrush, Newcastle (Co. Down), Kilkee, and Glengarriff, for example. In England there is Scarborough for those who like gay society; and Whitby for those who prefer a quieter place. Some find the high and dry inland air of Harrogate to suit them best; and those who can afford a continental trip have the very thing they require at Homburg—that is, a variety of pleasant excursions to make and the purest air to breathe. For young men, a pedestrian excursion through Connemara, the Highlands of Scotland, or the English lake districts often proves a pleasant antidote for simple dyspepsia. The exercise should, especially at the beginning of the trip, be moderate. A walk of twenty miles is equal to a day's hard work at the plough or in other laborious occupations.

CHAPTER XXV.

DISEASED AND UNSOUND FOOD.

The contagious diseases of the domesticated animals (epizootics) resemble in their mode of propagation the zymotic diseases which afflict the human race. Some of them are capable of becoming zymotics, of which we have a proof in the conversion of bovine variola into human vaccinia; and even when the virus of an epizootic is incapable of producing its characteristic symptoms in man, it still in some cases develops some form of disease which occasionally terminates fatally.

The following epizootics are those from which the farm animals of these countries have most suffered:—The rinderpest, or contagious typhoid fever principally affects oxen; but occasionally the sheep suffers from it. It is endemic in the southern parts of Russia, and would now be endemic in Great Britain but for the vigorous measures adopted for its extirpation when it broke out in these countries eight years ago. Contagious lung distemper seldom affects any animal save the ox. The ox and sheep suffer from small-pox, but the pig appears to enjoy exemption from this complaint. A disease popularly termed “the soldier,” which resembles scarlet fever in man, is often endemic in Ireland, and is generally a fatal affection. The poison of anthrax affects cattle, sheep, and swine, and is occasionally a great scourge. The so-called splenic apoplexy (the *maladie du sang* of the French veterinarians) of oxen; the “black-leg” or “quarter-evil” of calves and young cattle; the gloss anthrax of oxen and pigs; the “braxy” of sheep; the carbuncular cynanche, or anthracoid angina, the hæmorrhoidal anthrax, and the gangrenous erysipelas of the pig, and the malignant boil which attacks the latter animal’s throat—all are forms of carbuncular fever.

Panzootic aphtha affects all the domesticated animals. In Dublin there have been several outbreaks of this malady amongst the dairy cows. Eczema epizootica, or foot-and-mouth disease, chiefly ravages our herds, but it often attacks our flocks. It is one of the least fatal of the epizootics, but perhaps the most contagious. The disease is an eruptive fever, and its characteristic symptom is a vesicular eruption on the mucous surface of the mouth and adjacent parts, and on parts of the skin uncovered with hair—the udder and between the digits, for example.

Parasitic diseases of the domesticated animals are common. “Sturdy” is occasioned in the sheep by the presence of a bladder worm (*Cœnuris cerebralis*) in the brain. The “rot” in cattle and sheep is caused by the presence of very large entozoa, termed

flukes (*Distomæ hepaticæ*), in the animal's liver ; but there is no evidence to prove that the flukes found in the liver of sheep or oxen find their way into the livers of men. Dr. Cobbold states¹ that in America and Australia the pig is often afflicted with the parasite *Stephanurus dentatus*. It is sometimes $1\frac{3}{4}$ inches in length. It is conjectured that it may be the cause of the "hog cholera."

The disease termed measles in pigs is produced by the presence of great numbers of *Cysticerci cellulosa*. They are found in all parts of the animal's flesh, but they are most abundant just beneath the skin, on which they elevate what we may term measle mounds. The worms are found in bags which are situated between the muscular fibres. Measly pigs are distinguishable by the protuberances on the inner surfaces of their eyelids, and on the under surface of the tongue, by a yellow speck in the angles of the eyes, and by their thickened neck and thin loins. Measly pigs are very common in Ireland, much more so than in either England or Scotland. The ox also suffers from a species of measles.

There is little doubt but that the pork measle is an immature tape-worm, which, when it passes alive into the human body, may become developed into that human entozoon. Thorough cooking undoubtedly destroys the measle-worm ; but pork sausages are sometimes eaten when they are far from being completely done. I have reason to know, too, that measly pork is very likely to be employed in the preparation of sausages ; and it is not a pleasant reflection to think, when discussing this savoury kind of meat, that we are possibly introducing into our body the embryo of a tape-worm ten yards long !



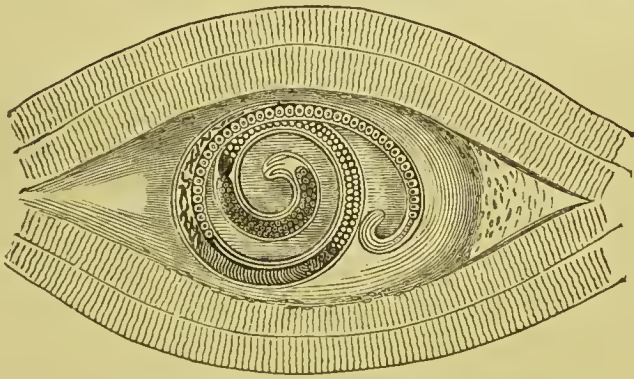
Measle worm, partially protruded from its bladder.

In 1835 Professor Owen described the structure of a human entozoon which had been discovered two years previously by a Mr. Hilton, demonstrator of anatomy in one of the London medical schools. From its hair-like form he termed it *trichina*, and as it was found coiled up he added the adjective *spiralis* to its name. The *trichinæ spiralis* have since been discovered in the bodies of a great number of persons, and the disease induced by their presence has been termed *trichiniasis*. Since the discovery of the trichina in man several hundred cases have been detected ; but it is probable that many persons die of *trichiniasis* whose decease is attributed to other causes, for the diagnosis of this malady during life is sometimes difficult. In Germany this disease has appeared more frequently than in other countries ; and several times during the last few years it has assumed the proportions of an epidemic. In one small town, Hettstädt, in Saxony, four outbreaks occurred between September,

¹ Monthly Microscopical Journal, November, 1871.

1861, and March, 1864. 192 persons were known to be affected, of whom 28 died. In July, 1864, 70 cases occurred at Strassfurt, in Prussia, of which several proved fatal. Trichiniasis has been observed not only in the British Islands and in many parts of the Continent, but also in America. In 1836 the late Dr. Harrison, of Dublin, stated at a meeting of the British Association that he had detected six cases of trichinæ in the human subject. Since that time the anatomists of this city have occasionally encountered this worm. In 1870 I saw thousands of them in the body of a man at Steeven's Hospital Medical College; and since then they have been detected in a subject in the Medical School of the Royal College of Surgeons. Trichiniasis is a very painful disease, producing fever, diarrhœa, headache, and excruciating muscular pains, resembling those occasioned by acute rheumatism.

Zoologically considered, the trichina is the juvenile condition of a very small nematode worm. From the eggs of this worm, which are deposited in the intestinal canal, the embryo issues, in the form of a minute thread, which immediately begins to bore its way through the abdominal wall into the muscular tissues. In about a fortnight the thread is developed into the well known form of the trichina, which, gradually coiling itself up, finally becomes invested with a coating of calcareous matter—that is, becomes encysted. The diagram shows the appearance presented by



TRICHINA SPIRALIS.

a trichina and its capsule. The trichina lives for a long time in his hermit-like cell, and in the encysted condition is harmless, or nearly so, to the human subject. When pork containing a trichina is eaten, the juices of the stomach dissolve the calcareous cyst, and the liberated worm is then free to wander through the body and to multiply itself. The numbers of trichinæ which have been detected in morsels of flesh are very great. In a small piece—about ten grains weight—of the tongue of the subject to which I have already referred I estimated the presence of at least 250 trichinæ. In some instances of trichiniasis in man, I have no doubt but that millions of these worms were present. The trichinæ

have been found in rats, dogs, moles, hedgehogs, sheep, carnivorous birds, and even in frogs. By the aid of the microscope, the presence of trichinæ and other entozoa is readily detected.

The *Tænia mediocanellata*, occasionally found in man, is said to be derived from beef.

The disease which is most fatal amongst oxen in this country is contagious pleuro-pneumonia. There are two forms of bovine pleuro-pneumonia—one resembling that disease in man, and non-contagious; the other a highly contagious and much more fatal malady, imported into this country from the continent in 1841, and now unfortunately completely domiciled here. The usual symptoms of contagious pleuro-pneumonia are very marked. The attack is generally ushered in with shivering; next a slight cough is heard, which gradually increases in severity as the disease progresses. The pulse is full, and ascends from about 70 to over 100; but ultimately it becomes weak and indistinct. The temperature increases, and the symptoms of acute fever present themselves. In the severe stage of the disease there is usually a very loud respiratory murmur; and at each inspiration the nasal cartilages rise spasmodically. Pressure on the spine produces great pain. The eyes become bloodshot, and foam often issues from the mouth. By means of the stethoscope the serious structural changes which the lungs undergo are readily determined. The dry, sonorous râle of ordinary bronchitis is observed; and a sound as if pieces of leather were undergoing friction may be observed until the last stage of the disease over a large portion of the thoracic surface. There is often diarrhœa. The *post-mortem* appearances are striking. There are extensive adhesions between the costal and visceral pleuræ. The trachea contains large quantities of false membranes. The lungs are enormously increased in size, and are frequently hepatized to the extent of three-fourths of their volume. There is great destruction of lung tissue. The pulmonary lobules are reddish-brown, and being cemented by layers of dense and lighter-coloured lymph, the whole mass often presents an appearance resembling that of Sienna marble. The quantity of purulent matter infiltrated through the lungs and occasionally accumulated in cavities and abscesses is sometimes very large. I have seen nearly a gallon of purulent matter flow from the lungs of a single cow. The lungs often attain to an enormous weight. In their healthy condition their average weight is about 12 lbs.; in advanced stages of pleuro-pneumonia they generally weigh from 30 to 70 lbs. On one occasion I found them to weigh 100 lbs. This disease generally terminates fatally.

The flesh of well-fed oxen, killed whilst affected with pleuro-pneumonia, varies very much in appearance. In the congestive stage of the malady the flesh is undistinguishable from that of healthy oxen. In the latter stages of the disease, and immediately after death, it frequently, but by no means invariably, presents a somewhat abnormal appearance; but on the following day it is not

difficult—at least to the initiated—to distinguish it from healthy beef. Good meat possesses a dull red hue and a marbled appearance. It is firm to the touch, and the texture is less elastic the day after the death of the animal that furnished it. Its odour is not disagreeable. On the contrary, the flesh of diseased animals is more flabby the day after they are slaughtered; it is rather plastic and moist, and its membranes exude a glairy liquid. On the first day its colour is generally preternaturally red, but on the second, and especially the third day, it acquires a dark brown shade. Dr. Letheby says that in diseased meat the juices, instead of being, as in the case of healthy flesh, acid, are often either neutral or alkaline. I have never found this to be the case until at least twenty-four hours after death, when probably it was caused by ammonia being liberated from the decomposing blood—for diseased meat decays very rapidly. When the medical officer inspects a carcass of beef from which the viscera have been removed, he should examine the cavity of the chest carefully to see if pieces of unsound lung still adhere to the ribs. The membranes are often carefully scraped off the latter to prevent such an observation from being made, but in such cases the bone is laid bare.

The medical officer should condemn, as unfit for human food, the carcasses of animals affected with carbuncular diseases, contagious pleuro-pneumonia, and similar serious diseases, and, in the pig, scarlatina. The flesh of animals in a parturient state is unfit for food; also that of animals very emaciated or highly inflamed from ill-usage, or putrid. Certain parasitic diseases, such as the measles and trichina worms, render meat unfit for food.

The milk of cows affected with pleuro-pneumonia does not appear to have been much investigated. I find that it generally contains a high proportion of solids; and in two instances, where the cows were actually dying, I found bacteria and vibriones in their milk—a clear indication that retrograde metamorphosis of matter was taking place in it. The losses sustained by the Dublin dairymen, in consequence of the ravages amongst their herds, is very great. So far as I can learn, during the last year at least 12 per cent. of their stock suffered from the disease. The dairymen cannot be convinced that the disease is contagious, and therefore, unless under compulsion from the sanitary authorities, they never disinfect their premises after the removal of diseased animals from them. In many cases, too, the vital powers of the cows are lowered by their constant respiration in close and foetid stables. In some of the sheds the cubic space allowed to a large cow is even less than the *minimum* 300 cubic feet of breathing room allowed to a man in the registered lodging-houses. I once saw a large number of dairy cows so close to each other in a dairyman's stable that it was quite impossible they could all lie down together. On questioning their owner on this point, he facetiously replied, "Gorrah, sir, they take it turn about!"

The trichinæ exist in the pig, and when the flesh of this animal

is eaten by man the worms migrate from the stomach to the most remote parts of his body, producing by their passage through the tissues the most agonizing pain. Prolonged boiling or thorough roasting destroys the vitality of these worms. If, however, the cooking be imperfectly accomplished, the trichinæ pass alive into the stomach. Neither smoking nor salting kills them, for Mosler found them alive in a ham kept for ten months. The greatest danger is to be apprehended from sausages, the central parts of which are often underdone, whilst the outer part is overdone. The cases of trichiniasis which have occurred in Dublin do not prove that the entozoa exist in Irish pigs; for they may have been derived from foreign bacon or ham consumed by the unfortunate patients. I have repeatedly carefully sought for trichinæ in the pork and bacon of home production, but never succeeded in discovering them. At the same time, I am far from believing that they do not occasionally occur in Irish pigs, though they have not yet been discovered in them.

The power to carry out a compulsory inspection of meat and other kinds of food is entrusted to certain local authorities¹—corporations, town councils, boards of guardians of the poor, &c.—by the Nuisances Removal Act, 1863, which is incorporated with the Sanitary Act of 1866 (29 and 30 Vict., cap. 90). Some doubt having arisen as to the extension of the clause of that act relating to food to Ireland, the point was cleared up by a short act of parliament, passed (32 and 33 Victoria, cap. 108) at the request of the Public Health Committee of the Corporation of Dublin.

In 1867 I succeeded in organizing a very efficient system of inspection of the meat, fish, and fresh vegetables on sale or in preparation for sale in Dublin. Four sergeants and constables of the metropolitan police are employed for the sole purpose of inspecting the slaughter-houses, butchers' stalls, cattle, fish, fruit, and vegetable markets, and all other places where meat, fish, and vegetables are to be found. They are paid by the Corporation, and act under an inspector of food. These five officers are commissioned as inspectors of nuisances, which, under the Sanitary Act of 1866, gives them the right of entry into certain premises, and the power to seize food if they suspect it to be diseased or otherwise unsound. The whole police force of the city and suburbs co-operate with the inspectors. For example, when a sick animal or unsound carcass is detected, an ordinary policeman is placed in charge of it until it is disposed of. Whenever there is the slightest doubt as to whether food under seizure is sound or not I inspect it, and either pronounce it sound or give a written certificate stating that it is unfit for human food.

Before an official inspection of meat was organized in Dublin, the usual practice was to send up to this city the carcasses of cows,

¹ The powers of all these bodies have been transferred to the urban and rural sanitary authorities by the Public Health Act of 1874.

sheep, and pigs that died or were killed whilst diseased, within a radius of at least twelve miles from the city. Every dairy cow that had pleuro-pneumonia, or that died or was killed during parturition, found its way into the shambles. It is a fact that the Dublin knackers formerly rarely had the carcass of a cow sent to them, whilst now not a day elapses without one or more head of horned stock being consigned to them. From 220,000 to 500,000 lbs. weight of diseased and otherwise unsound food are annually confiscated in Dublin, and persons are constantly fined and imprisoned for attempting to dispose of diseased or putrid meat.

During the year 1873 the following quantities of unsound food were condemned in the City of Dublin:—208 carcasses of oxen, 55 carcasses of sheep, 14 carcasses of veal, and 109 carcasses of pigs—total, 386 carcasses. There were also condemned numerous fragments of carcasses, together with fish, vegetables, &c., of which the following (including the whole carcasses and vegetable-food) is a complete return:—

				Pounds.
Beef	...	...	...	147,815
Veal	...	...	...	2,100
Mutton	...	..	...	6,640
Pork	...	...	...	19,356
Bacon	...	...	...	7,139
Fish	...	...	...	34,220
Butter	...	...	...	72
Fruit and Vegetables	...	...	...	450
Bread	...	...	..	6,000
Flour	...	..	...	560
Tea	..	...	...	200
Total	...	...	...	224,552
Animal Food	...	...	...	217,342
Vegetable Food	...	...	...	7,210

Of the 21 persons convicted during the year for selling or being possessed of diseased or unsound meat 11 were fined £49 17s. Of the others 10 were imprisoned—3 for 3 months each, 3 for 2 months each, 2 for 6 weeks each, and 2 for 14 days each.

There is considerable diversity of opinion relative to the amount of injury to human health and life occasioned by the use of the flesh of animals slaughtered whilst in a diseased condition, parasitic maladies being excluded. If we adopt the opinion of the distinguished French writer on hygiene, Parent du Chatelet, the human stomach is capable of digesting, without injury to the system, the most highly diseased and putrid kinds of flesh. During the last great outbreak of rinderpest in England and Scotland, thousands of oxen, killed whilst affected with the disease, were eaten, and it is asserted that no bad results followed. In Ireland, where contagious lung distemper has been prevalent since the year 1841, the carcasses of immense numbers of animals affected with that disease

must have been used as food, and yet we do not know of any serious consequence to human life or health having resulted therefrom. It must, however, be admitted that until quite recently very little attention has been devoted to the subject of the influence on health produced by the use of the flesh of diseased animals. Perhaps the consumers of the beef furnished by cattle affected with pleuro-pneumonia have not enjoyed that immunity which stock-feeders, salesmasters, and butchers maintain has been the case. A man taken ill after dining upon a beefsteak not obviously unsound would seldom attribute his indisposition to the use of diseased meat. Negative testimony is not, however, worth much in most cases, and that perfectly fresh meat is sometimes capable of producing disease, and even of causing death, is a fact of which there is abundant positive testimony.

Dr. Kesteven, in the *Medical Times* for March 5th, 1864, mentions a case where 12 persons suffered from choleraic symptoms after the use of pork, which was neither putrid nor poisoned. The disease called braxy, which affects sheep, is very common in Scotland. When the flesh of a braxy sheep is eaten fresh, it is likely to produce disease; but when corned it is generally, though not always, consumed with impunity. According to Dr. Leared, 20 per cent. of the deaths in Iceland are caused by parasites derived from the flesh of the sheep.

Professor Gamgee states that several cases of illness produced by the use of the flesh of animals suffering from inflammatory diseases have come under his observation. According to Dr. Livingston, in South Africa the negroes and Europeans who eat the flesh of oxen affected with pleuro-pneumonia suffer from malignant anthrax; and it is a significant fact that since the introduction of this epizootic into England the mortality from carbuncle and phlegmons generally has steadily and largely increased. During the five years before the appearance of the lung distemper the annual deaths from phlegmons averaged 5 per 20,000 deaths from all causes; whilst during the ten years ended in 1856 the mortality from these diseases rose to 162 per 20,000 deaths. The Registrar-General for Scotland states that the mortality from carbuncular diseases has greatly increased in that country since pleuro-pneumonia became an endemic disease amongst its herds.

Dr. M. Pétry, in a communication¹ to the Belgian Royal Academy of Medicine, refers to the frequent production of carbuncular disease in man from the use of the flesh of diseased animals. He gives us the history of an outbreak of malignant pustules amongst the inhabitants of the village of Coudroz, which was clearly traced to the consumption as food of the flesh of an ox affected with charbon.

¹ Considerations Pratiques sur le Typhus Bovin et Charbonneux. Bulletin de l'Académie Royale de Médecine de Belgique. Année, 1872. Tome vi. No. 9.

In 1866, at Newtownards, county of Down, two persons died and others suffered severely, after eating veal not obviously unsound, and in which Dr. Hodges could not detect poison.

In No. 7, Vol. 6, of the *Bulletin de l'Académie Royale de Médecine de Belgique*, M. Kuborn, in a lengthy article relating to the injury inflicted on the public health by the consumption of diseased meat, proposes that the carcasses of all animals affected with contagious diseases should be burned. He describes a process of incrimination which would not give rise to a serious nuisance; and he considers that his plan, if perfectly carried out by the authorities, would eventually destroy the parasitic and contagious diseases of animals used as food.

Many cases of poisoning by shell-fish are on record. In 1827 nearly thirty persons were poisoned by mussels at Leith. In the *Lancet* for February 15, 1873, a case of poisoning by these molluscs is reported. The schoolmaster of the Union Workhouse, Falmouth, took fifteen of the boy inmates of that institution for a walk on Mainford beach. It would appear that they picked up and ate some mussels, which were abundant on the rocks. One of the boys speedily fell down in a fit, and soon after three other boys became similarly affected. Three of the boys died within an hour, and the fourth recovered. Many kinds of shell-fish and fish occasionally assume poisonous properties, from causes which at present are unknown. In one instance, however, Bouchardat proved that the poisonous effects produced by mussels taken from a particular place was due to the presence of copper in the shell-fish.

A remarkable account of an epidemic amongst fish is given by Dr. Ogle in the *Lancet* for November, 1874. The disease resembled typhoid fever in man, and whilst the blood of the fish contained vibriones and bacteria, that of the healthy fish was free from bacteridæ. The ill effects sometimes observed after eating perfectly fresh fish may occasionally be due to the animal having been diseased.

As I have so much experience in relation to diseased meat, it may be presumed that cases of illness produced by its use occasionally come under my notice. Such is the case. Persons call on me from time to time to complain that they or members of their families have been made ill by eating what they believed to be diseased meat. Sometimes they bring a portion of the offending article. This occasionally is semi-putrid, but more frequently it is fresh; in the latter case it generally possesses a sickly, cadaverous odour. Measly bacon is often complained of; and I have seen several persons who referred severe illness, which they were suffering from, to the use of bacon or pork containing the *Cysticercus cellulosis*. In July, 1870, I inspected a cow's head, a portion of which had been eaten by a family, all of whom shortly after were affected with retching and diarrhœa. The part of the head that remained was not even slightly putrid, but it emitted a loathsome odour, resembling that so often smelled in the chambers of the

sick. It appears that the fleshy portion of the head had been in great part removed from the skull, and broiled on embers, which probably only imperfectly cooked it. A strong man—a labourer in a timber yard—his wife and children, partook of the meat, with the simple addition of bread; the man ate heartily, but the woman and her children only used a small portion of the meat. Less than an hour after their dinner the whole family became unwell, with diarrhœa and vomiting, but, with the exception of the man, they recovered in less than twenty-four hours. The husband, however, remained in bed seriously ill for nearly a week. I happened to see him thirty-six hours after his unlucky meal, and found him much prostrated. His tongue was very foul, his pulse feeble, and he particularly complained of pain, accompanied by a sickening sensation, in his stomach. For nearly two days he had very bad choleraic diarrhœa. I carefully examined a portion of the cow's head, but I found no evidence of parâsitic disease.

A case of poisoning by rancid butter came under my observation in April, 1873. A tradesman and his family became unwell after partaking of breakfast, consisting of tea, cold meat, bread, and butter. The father complained at the meal of the quality of the butter, and with difficulty forced himself to swallow it; shortly afterwards his stomach became sick, and, to use his own words, he felt the rancid butter coming up his throat. Two of his daughters became very unwell almost immediately after breakfast; they suffered severely for some time from choleraic diarrhœa. They were admitted into the Mater Misericordiæ Hospital, Dublin, where the younger girl, Julia Cummins, aged eight years, expired in the evening. I examined the contents of her stomach, the matter ejected from the father's stomach, and portions of the unconsumed food from the morning meal, but no poison was detected therein. The meat, of which only a small portion had been eaten, presented all the characteristics of the flesh of a healthy animal; but the butter was rancid in the most extreme degree—indeed, its odour alone was almost sufficient to make a delicate person ill. I felt no hesitation in coming to the conclusion that the butter had poisoned the family; and the verdict of the coroner's jury, who inquired into the case of Julia Cummin's death, was in harmony with that belief.

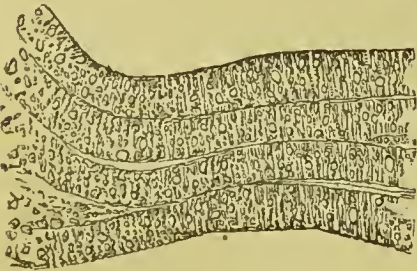
In August, 1869, I visited a family, consisting of six persons, all suffering from choleraic diarrhœa, which they could only attribute to the use of some chops which had constituted the staple item of their dinner. On inquiring closely into the facts of the case, I came to the conclusion that the surmises of the family as to the cause of their complaint was correct. A portion of the chops had remained, and although quite fresh, it had the disagreeable, sickly odour which I have so frequently observed in the case of the flesh of animals obviously diseased.

In 1873 a severe outbreak of choleraic diarrhœa occurred in the workhouse, Tralee, which I found could only have been caused by

the use of porridge made from stirabout extensively affected with fungi.

During the last few years more than a score persons have been summoned before the Lord Mayor and the police magistrates for having sold meat which witnesses swore in court had made them unwell. In every case I carefully inspected portions of the meat complained of, and found that it was generally more or less putrid, or that it possessed a rank odour, or that parasites were present in it. In three or four cases, however, the meat did not present any external appearance of disease.

It is urged by those who assert that the flesh of diseased animals is, except under very exceptionable circumstances, wholesome food, that neither the chemist nor the microscopist has as yet discovered any specific poison in it, except such parasites as *trichina spiralis*. It must, however, be borne in mind that Lionel Beale has vainly sought for the contagium of several diseases by means of a microscope so powerful that if it were possible to look at a man through it he would appear to be as tall as Chimborazo. With this instrument he could only discover as abnormal a little granular matter in the blood taken from a cow affected with rinderpest. It is unreasonable, therefore, to demand that before the flesh of animals suffering from loathsome diseases is prohibited as an article of food, the chemist or the microscopist, or the pathologist, shall demonstrate that it contains an isolable poison or virus. The purchasers of butchers' meat would not buy the flesh of an animal that they knew had such a disease as black-leg or lung distemper; and should there be even a slight doubt as to the unwholesome nature of such food, it is clearly the duty of the sanitary authorities to place an interdict upon its sale in open market.



FIBRES OF FLESH BROKEN UP
BY FAT.

The flesh of over-fattened animals is said to be unwholesome, but there is no good evidence in support of that statement. At the same time, I am disposed to believe that the flesh of those bovine monsters that carry off prizes at our agricultural shows is deficient in nutritive power. The fibres of their muscles are either partially replaced by fat, or literally smothered in enormous quantities of that tissue. The diagram shows the structure of muscular fibres broken up by fat.

A very objectionable kind of animal food is that termed "slink veal." It possesses a loose texture which allows a large quantity of air to be blown into it—usually from the *lungs* of the butcher or his assistant. It is very

liable to cause diarrhoea, and its use should be prohibited when cholera is epidemic. It is not a nutritive food, the greater part of its solid constituents consisting of indigestible nitrogenous matters. I found in veal one day old—

Water ...	...	...	...	...	72.25
Fat ...	...	...	...	...	6.17
Nitrogenous matters	...	...	...	...	18.46
Mineral matters	...	...	...	...	3.12
					<hr/>
					100.00

Several cases of *herpes contagiosus* have been referred to the use of the milk of cows affected with foot-and-mouth disease. In the annual report of the Medical Officer of the Privy Council for 1869, Dr. Thorne shows that a disease is sometimes produced in the human subject when the milk of cows suffering from foot-and-mouth disease is freely used without being boiled. In 1871 foot-and-mouth disease prevailed extensively for about two months in Dublin. The fatality from it was not high—probably 2 or 3 per cent. I made careful inquiries as to the effect which the milk of some of the affected animals produced on the health of those who drank it, but I could not get much satisfactory information. In one instance only did I ascertain that the milk of cows seriously affected with the malady probably produced disease. Three children, who largely consumed the milk, both cooked and uncooked, suffered very much from aphthous patches in their mouth and on their lips. There is the clearest evidence that several pigs died in consequence of being largely fed upon the milk of cows suffering from epizootic apthæ.

In 1870, Dr. Ballard, Medical Officer of Health for Islington, London, traced the cause of a local outbreak of typhoid fever in his district to the use by the affected persons of milk supplied from a particular dairy. Between the 3rd of July and the 10th of September, 1870, 168 persons, part occupants of 67 houses, contracted typhoid fever, and in 26 of the cases the disease terminated fatally. The radius of the district in which the 168 cases of typhoid fever occurred is a quarter of a mile. Outside this radius the number of fatal cases of typhoid fever which occurred in the whole of Islington, which has an area of 3,127 acres, amounted to 20. Six of these cases, Dr. Ballard ascertained, had originated outside the parish of Islington.

As the people in the limited circle were living under very fair sanitary conditions, in good houses and in a well sewered locality, Dr. Ballard came to the conclusion that all or nearly all the cases were due to a common and strictly local cause, which he proceeded to investigate exhaustively. He found that all the families amongst whom death from typhoid fever had occurred were supplied with milk from the one dairy. He ascertained that the

owner of this dairy had died from typhoid, and that seven of his family and servants had suffered from the disease. It appeared also that typhoid had occurred in a family who lived in a small cottage in the cow-yard belonging to the milk vendor, and situated about 100 yards from the dairy. Several other persons employed about the dairy, but who did not reside upon the premises, were affected with typhoid.

One hundred and forty-two families were supplied with milk from this dairy. The district in which those families resided contained a population estimated at about 2,000 families, so that only a small proportion of the inhabitants of the district were supplied with milk from the dairy in question. Out of those 142 families (which included the dairyman's household) 70 were attacked with typhoid. The number of individual cases amounted to 175, of which 30 terminated fatally. "Inquiring," says Dr. Ballard, "as to the source of milk supply in all other instances of typhoid in the parish, during the same period, that came to my knowledge, I scarcely ever heard the name of any one milkman mentioned twice."

Dr. Ballard examined the dairy premises, and here he found two possible sources of typhoid poison, namely, the offensive effluvia from stable drains, and an underground water tank which supplied a pump; by analysis, the pump water proved as pure as that of the "New River" water, which is supplied to that part of London, and with which the tank was in communication. The tank was explored, and it was discovered that the rats had burrowed into the bottom of the tank, and had established a communication between it and two old drains. Although there was a new drain intended for the conveyance of effete matters from the house, it was seen that during heavy rains, stoppage of the new sewer, or, from other causes, foul liquids and offensive effluvia could readily pass into the old drains, and from thence into the tank. There is no positive evidence that the milk sent out from this dairy was adulterated with water, but the universal practice of milk adulteration which prevails in these countries leads one to infer that in the dairy in question the milk was mixed with water. There is evidence to prove that the milk was frequently complained of, both on the ground of its being poor and by reason of its offensive odour. It is admitted that two qualities of milk were sold, one at 4d., the other at 5d. per quart. The workpeople also stated that although they did not mix the water from the underground tank with the milk, they used that water for the purpose of washing and rinsing the cans.

From the results of this investigation Dr. Ballard concluded that the outbreak of typhoid was due to the use of milk from this dairy, and it is impossible not to believe with him that the contagium was introduced into the milk by water which had been contaminated with sewage. Dr. Ballard was not, indeed, the first to observe this mode of disease communication; for Dr. Bell, of St. Andrews, had previously shown that the poison of scarlet fever

had been conveyed through the same medium. The cows in this case had been milked by convalescents from scarlatina.

In January, 1870, a woman applied for medical relief at Steevens' Hospital. She was in her usual health when she took a drink of milk which had just been brought from a neighbouring dairy. Instantly she became unwell, with severe diarrhoea and retching. A portion of the milk was examined by me, and found to contain 35 per cent. of added water, and to possess a strong odour of sulphuretted hydrogen. On boiling the milk the foetid odour disappeared. In this case it was clear that foul water had been used to adulterate the milk.

During the last epidemic of cholera in Dublin, Dr. Robert M'Donnell directed attention to an outbreak of the disease amongst some of the prisoners subjected to solitary confinement at Mountjoy Prison. It was considered at the time remarkable that the disease should have attacked persons who were apparently peculiarly protected from contagion, whilst, I believe, not one of the prison officials contracted the disease. The fact was altogether at variance with the current theories of the propagation of cholera. I suggested to Dr. M'Donnell that it was probable the contagium of the disease had been conveyed to the prisoners through the medium of milk adulterated with contaminated water. There was cholera in the locality from whence the milk was obtained, and if I remember aright one of the contractors who supplied the article died from the disease. It is notorious that the milk supplied to the Dublin Public Institutions was at that time generally adulterated with water, usually derived from pumps situated in the dairy yards.

A case of the propagation of typhoid by milk is described in the *Medical Times* for March 15, 1873, by Dr. Russell, Medical Officer of Health for the City of Glasgow. In the suburb of Parkhead, enteric fever, previously a rare disease in the locality, became prevalent. The water used in the district being good, the sewerage arrangements satisfactory, and the people "comfortable, cleanly, and well living," an outbreak of enteric fever surprised the sanitary authorities. Dr. Russell made inquiries, and found that the earliest case of typhoid fever occurred in the house of a dairyman: out of seventy-three families (in five streets only) supplied with milk by this man, twenty-two had fever; whilst out of 146 supplied with milk by other vendors, only two contracted typhoid fever.

Dr. M. K. Robinson, Medical Officer of Health for Leeds, in his report on the sanitary condition of the borough for 1872, describes an outbreak of enteric fever similar to the Parkhead and Islington cases. More than one hundred customers of a milk vendor were affected with this disease immediately after it had appeared in the dairyman's house. Dr. Ballard, Medical Inspector of the Local Government Board, investigated the case, and came to the conclusion that the disease had been spread through the medium of milk.

In July, 1873, a sudden outbreak of enteric fever occurred in Marylebone, London, one of the most wealthy and salubrious districts of the metropolis. The disease appeared in the course of a few weeks in no fewer than 123 families. Many facts indicated that the cause of the outbreak was poisoned milk. Out of the 123 families affected with the disease, 106 obtained their milk from one source—namely, one of the new companies established for the purpose of supplying the metropolis with pure milk. The facts of this case have been investigated by Dr. Murchison, Dr. Whitmore, Mr. Netten Radcliffe, Dr. Corfield, and Mr. Morton, and the results of their inquiries leave not a shadow of a doubt as to the origin of the outbreak. Indeed, the milk company, after a vigorous attempt to shift the responsibility from themselves, were at length obliged to admit that the milk was the cause of the epidemic. In a letter addressed to the *Times*, 26th August, 1873, the secretary of the company stated:—"There is now, we regret to say, no doubt that a large per centage of the recent cases of typhoid fever in Marylebone, as in some other districts, has been caused by milk supplied by this company." This admission was made after it had been clearly shown that there was typhoid fever at one of the dairy company's farms, and that one of the men employed there had died from it on the 8th of June. It was also shown that the sanitary condition of this man's dwelling, and of the farm generally, was very bad, and that the water could hardly have escaped contamination from typhoid poison.

The evidence in favour of the assertion that the outbreak of typhoid fever in Mayfair was due to the use of the milk from the "Dairy Reform Company" was, as I have stated, of the strongest possible nature. In a house where two servants, on board wages, used the suspected milk, and two other servants milk from another dairy, the former got typhoid, the latter escaped. In the house of a nobleman the servants, ten in number, used the suspected milk, and five sickened from typhoid; whilst of the family, who used milk derived from another source, not one contracted the disease. A titled lady purchased the suspected milk: two of her three children, who drank it night and morning, caught typhoid fever; the third, who took tea in the morning and orange wine and water at night, escaped. The foregoing are only a few examples of the nature of the evidence against the dairy company.

The disease chiefly attacked children, evidently because they were the principal consumers of the milk, and used it to a great extent uncooked. In the family of a physician supplied with the suspected milk no case of typhoid occurred, but it appears that in his household the milk was always boiled before being used. Contaminated milk mixed with hot tea might thereby be deprived of its noxious property. The thorough boiling of milk from cows affected with foot-and-mouth disease has been found to destroy the poison which, it is well known, exists in the fresh milk. The same process probably destroys the virus of typhoid in milk; but, never-

theless, we should hesitate to make use of any cooked liquid which might probably contain the contagious matter of enteric fever.

One good consequence of the outbreak of typhoid from the use of poisonous milk is that the Dairy Reform Company have decided to appoint a medical officer to supervise the sanitary condition of their numerous farms and dairies, and they have appointed an analyst to test the quality of the milk. A new association, entitled the Sanitary Milk Company, has also been projected, for the purpose of supplying milk guaranteed to be free from adulteration, and, as far as the most perfect medical and veterinary supervision can prevent it, free also from animal poisons of all kinds.

In August, 1873, an outbreak of enteric fever in Brighouse, Yorkshire, was attributed, by Dr. Thomas Britton, of Halifax, to the use of poisoned milk. Of the 62 persons affected with the disease, 59 drank the milk supplied from a particular dairy. On discontinuing the use of the suspected milk the disease disappeared from the district.

Some other outbreaks of enteric fever have been referred to the use of milk poisoned with the germ of that disease; but it is not necessary to detail all of them.

Siegel¹ detected in a specimen of milk numerous spores and filaments of fungi. The milk attracted attention from the remarkable bluish hue which it possessed. He thinks that such fungi have the power of changing casein into aniline, and, therefore, of rendering the milk poisonous. He was unfortunately not able to trace the origin of the milk. Mosler found² that milk with a bluish hue (caused by fungi) produced severe gastritis.

CHAPTER XXVI.

ADULTERATION OF FOOD AND DRINK.

The Acts 23 and 24 Vic., cap. 84, and 35 and 36 Vic., cap. 74, relate solely to the adulteration of articles of food, drink, and drugs.

There are many classes of articles which are constantly adulterated—that is, mixed with inferior or worthless stuffs, which simulate the appearances, but do not possess the properties, of the genuine commodities. When this kind of fraud—for it deserves

¹ Pondenzblatt. No. 36.

² Virchow's Archiv. B. xliii., p. 161. (1868.)

no milder appellation—is practised upon food, not only are we robbed of our money, but even our health is often jeopardised; for several of the substances used in food sophistication are far from being harmless in their effects. In several Continental States severe laws have been enacted for the purpose of preventing the adulteration of food; the persons convicted for offences against those laws are not only fined, but are frequently imprisoned, and their names and misdemeanors advertised at the delinquents' expense in the newspapers. Several centuries ago food adulterators were severely punished in England. In the "Memorials of London" it is stated that in the year 1316 a man and a woman were sentenced to expiate on the pillory the offence of selling bread made of bad materials. Four years later, one William Speyling, detected in the act of selling putrid meat, was punished by having the unwholesome article burned under his nose—a species of chastisement which had a spice of humour in it; as was also the case when, in 1364, a vendor of bad wine was compelled to drink a large quantity of it. In 1419 Henry V. issued a proclamation threatening with the penalty of exposure on the pillory all who sold fraudulently compounded wine.

35 and 36 Vict., c. 74, enables the grand juries of counties and the municipal councils of towns in Ireland, having a separate court of quarter sessions (*i.e.*, Dublin, Cork, Belfast, Limerick, Waterford, Galway, Londonderry, Kilkenny, Drogheda, and Carrickfergus), to appoint public analysts. Such appointment must be approved of by the Local Government Board (formerly by the Lord Lieutenant), and the analyst cannot be removed from his office except with its sanction. The grand juries and municipal authorities can also appoint persons (who are already inspectors of nuisances, weights and measures, or markets) to collect samples of food and submit them for examination to the analyst; and should they prove to be adulterated, the inspector can summons the vendor. Up to the summer assizes, 1874, there have been appointed public analysts for the following districts:—Dublin, Cork, Belfast, Limerick, Waterford, Londonderry, Galway, and Kilkenny, and the counties of Antrim, Carlow, Clare, Dublin, Fermanagh, Galway, Kerry, Kildare, Kilkenny, Limerick, Londonderry, Longford, Mayo, Queen's County, Roscommon, Sligo, Tipperary (South Riding), Wicklow. The constabulary are inspectors of weights and measures; but up to the present the government have not permitted them to act as inspectors of food under the adulteration act, although strongly pressed to do so by several of the grand juries. The constabulary are well qualified to act as inspectors of food, and until they do so the acts in relation to adulteration will in counties remain to a great extent inoperative. Under existing circumstances, the law should be carried into effect by the urban and rural sanitary authorities in the following manner. The sanitary sub-officers should be appointed inspectors of food, and directed to procure samples for analysis in their various districts. When the

analyst resides within a reasonable distance, the inspector should proceed direct to him, deliver a portion of the sample for analysis, and seal up the remainder in the analyst's presence, and with the seal of the latter. Should the article prove to be adulterated and proceedings be taken against its vendor, the sealed sample must be produced in court, in order that the justices trying the case may, if they think proper, order it to be analysed by another chemist. Should the analyst reside at a distance from the inspector, a portion of the article to be examined should, in the first instance, be sent to him by post or rail. If the analyst report that he has found the article pure, the matter rests there; but should the converse be the case, then the inspector must personally deliver to the analyst a specimen from the portion which he had retained. The quantities necessary for analysis are—milk, sugar, cocoa, coffee, mustard, pepper, 1 oz. of each; tea, confections, butter, 2 oz.; flour, 4 oz.; bread, 1 lb.; ardent spirits, wine, and beer, 10 oz. The milk may be sent through post by packing the bottle containing it in a stout box turned out of a piece of solid wood, so that there could be no leakage even should the bottle be broken in transit. The alcoholic liquors must not be sent by post.

When the inspector personally delivers the articles to be analysed to the analyst, the certificate of the analyst is received instead of his parole evidence; but otherwise the analyst must give his evidence in court. Except in the Dublin police courts, there must be two justices present to try cases arising out of breaches of the adulteration laws. The fines levied under the act are payable into the fund of the local authority, corporations, &c., provided there is a public analyst for the district. Under the Act of 1860, it was necessary that notice should be given to the vendor that the article purchased from him was to be submitted to the public analyst, in order that the vendor, if he thought fit, might accompany the purchaser to see that the latter did not tamper with the article before he gave it to the analyst. The Act of 1872 does not require any such notice to be given; but some doubt exists as to whether or not it is still necessary, the section in 23 and 24 Vic., c. 84, requiring it not having been distinctly repealed by the later act. All the Dublin police magistrates are of opinion that notice is not required; and this opinion has been expressed by all the justices at petty sessions before whom adulteration cases have been tried. In one case in which a vendor of milk in Irishtown, Dublin, was fined for selling an adulterated article, the magistrate presiding—Mr. C. J. O'Donel—stated, on the application of defendant, a case for the Queen's Bench, asking whether or not notice was necessary. The Lord Chief Justice and another justice were of opinion that notice was not required; the other two justices held that it was: consequently, the judgment of the court below remained good. Although there was this difference of opinion amongst the judges, they were unanimous in expressing their belief that it had been the intention of the framers of the act of

1872 to repeal the section of that of 1860, in reference to notice of intention to have articles analysed. This is but one of the many loosely-worded and ambiguous statutes which puzzle and confuse even the judges of the land. Should there be a new act passed in relation to adulteration, it is to be hoped that its provisions may be clearly expressed, and that it will completely repeal the existing highly defective acts.

On the 27th April, 1874, the House of Commons appointed a committee to inquire into the operations of the laws relating to the adulteration of articles of food, drink, and drugs. The committee met on the 30th April, and elected Mr. Clare-Reid chairman. They met subsequently thirteen times, and terminated their labours on the 3rd July. They examined 58 witnesses, of whom the only chemists were Drs. Hassall, Voelcker, Tidy, Macadam, Wanklyn, Cameron, and Bartlett, and Messrs. Allen and Sutton. The other witnesses were chiefly persons engaged in the sale of articles alleged to be peculiarly liable to adulteration—tea, mustard, cocoa, &c. The committee report that although the act has done much good, it has, at the same time, inflicted injury upon some respectable tradesmen, owing chiefly to the want of a clear understanding as to what *does* and what *does not* constitute adulteration; but also in some cases to the conflicting decisions and inexperience of the analysts. The committee, therefore, recommend that the act should be amended to remedy its defects.

Their report¹ states that the act has been by no means general; and in many cases where it is applied, and officers have been appointed, its operation has been of the most restricted character. Even where competent analysts have been elected, special food inspectors were not associated with them.

Speaking of England, it says that the numbers of proceedings outside the metropolis and a few large towns were small. "The amount of good resulting from the act must not, however, be judged by the number of the prosecutions and convictions. The deterrent effects are undoubtedly great, and the opinion of the promoters has been substantiated, that the most beneficial effects of the act would be to prevent adulteration, rather than to punish it."

The committee recommend that a qualification of some kind for the office of public analyst should be created, and also that inspectors of food should have power to compulsorily purchase articles which they suspect to be adulterated, but which it was not likely would be voluntarily sold to them. This is, I think, the most valuable recommendation of the committee, and it is one which I pressed strongly upon the attention of the committee during my evidence.

The committee state that the fraudulent abstraction of cream should be punishable. With respect to butter, the evidence showed that it is not frequently adulterated, but that occasionally foreign

¹ Report of Committee on the Adulteration of Food Acts of 1860 and 1872.

butters are mixed with lard and other fats. "Attempts are being made in France and elsewhere to manufacture artificial butter, chiefly from the fat of animals: if these articles are composed of wholesome materials, and not sold as butter, your committee see no reason to forbid their sale. The slight colouring matter occasionally added to butter, cheese, &c., should not, in the opinion of your committee, be regarded as an adulteration." Bread, the committee state, on the whole, appears to be fairly pure. Potatoes are used to help fermentation, and rice flour is employed in dusting the loaves. No doubt, the chief adulteration is alum, and evidence was adduced showing the great difficulty which the best chemists experience in discovering minute quantities of alum in bread. The defect in the mode of determining alum in bread is, however, one easily remedied. The committee are disposed to allow mixtures to be sold as such, if properly labelled.

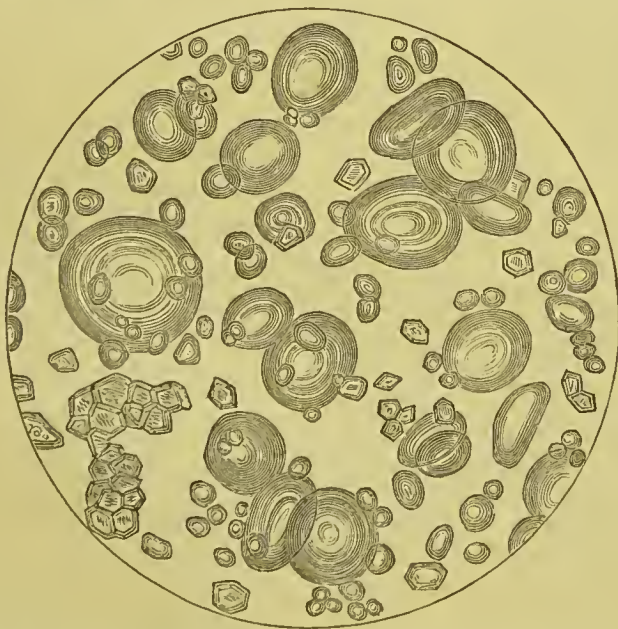
I submitted the following definition of adulteration to the committee at their request:—

An adulterated article is a substance to which has been added, for the purpose of sensibly increasing its weight, one or more cheaper substances, or to which has been added any substance injurious to health. A substance is impure, and not genuine, when it has been deprived of a portion or the whole of one or more of its essential ingredients, unless it is sold under a name which implies that such an abstraction of valuable constituents has taken place. For example, milk which has been deprived of a portion of its cream is to be considered an impure article, unless sold under the name of skimmed milk. An impure article of food, drink, or drugs also means that which, by reason of putridity, disease, or other form of unsoundness, is unwholesome, and unfit for the food of man. I would make the following exceptions—Any admixtures of foods, drinks, or drugs may be sold as such, provided that they do not contain ingredients injurious to health, and that they are not represented, by implication or otherwise, to be simple or uncompounded articles.—Page 251 of Report of Committee.

Wheat Flour and Bread are said to be adulterated with rice and other cheaper farinas, gypsum, alum, bluestone, China clay, and magnesia. Examine wheat flour with the microscope and compare its starch granules with those of other grains—rice, barley, maize, &c. Gypsum, magnesium carbonate, and clay constitute incombustible residues when 50 grains or 3 grammes of the flour are calcined in a platinum dish. The gypsum and magnesia dissolve in hydrochloric acid, the latter with effervescence, whilst clay is nearly insoluble. Chloride of barium added to the hydrochloric acid solution affords a copious precipitate of sulphate of barium, if gypsum be present. Fine white flour leaves from .5 to .65, and coarse flour from .7 to .9, per cent. of ash. Alum is added for the purpose of improving the appearance of the flour. To detect it, burn $\frac{1}{4}$ lb. of flour in a platinum dish (if only a small dish be available, make the flour into dough, bake it, and carbonize it on iron or platinum gauze over a clear gas or spirit of wine flame, and finally burn in a platinum dish). Heat the residue with a fluid drachm of strong oil of vitriol

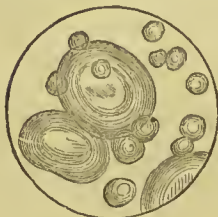
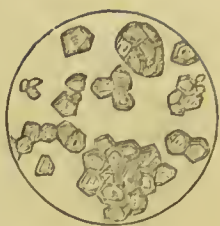
until fumes cease to be evolved; when cold, dilute with distilled water, filter, and add 30 grains of caustic soda; again filter and add a drachm of chloride of ammonia; boil, and if alum be present, a precipitate of alumina and phosphate of aluminium will, after a short time, be produced. Pure caustic soda is prepared by adding very small fragments of metallic sodium to water. By noting the amount of sodium used the solution may be employed, instead of the solid hydrate of sodium obtained by evaporating the solution to dryness. Sulphate of copper (blue-stone) is detected by dissolving the ash of the flour in acid, and adding ammonia in excess, which strikes a blue colour. A more sensitive test is to place the solution in a platinum crucible, and deposit therein a piece of zinc: the copper, if present, will be deposited on the sides of the platinum vessel. Bread is examined by the process just described, but larger quantities must be used. Good bread contains about 38 per cent. of water, 8 to 10 of nitrogenous matters, $1\frac{1}{2}$ of fat, and from 55 to 58 of gum, dextrose, sugar, and starch. It leaves, on combustion, about 1.2 per cent. of ash, of which about one-half is composed of common salt. In biscuits, the amount of water varies from 7 to 45 per cent.

The engraving shows the microscopive appearance of wheat flour adulterated with rice: the latter forms the small irregular particles; the large corpuscles are wheat starch.



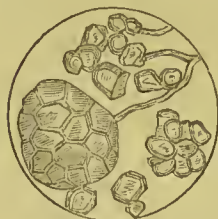
Fungi of various kind, vibriones, acari, and the larvæ of moths, are often found in great number in flour, and sometimes render it unuseable.

Rice.—The engraving shows the appearance presented by starch granules of rice when magnified 420 diameters. The cells of rice are also shown in this engraving. The starch corpuscles are very small, angular, and have depressed centres, and raised edges.



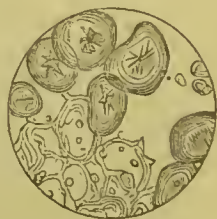
Wheat starch granules magnified 420 diameters. Some are very small, others very large ; they are chiefly round and have generally a depression (hilum) in their centres. The larger granules appear like thin-edged discs.

Rye.—This engraving depicts the starch corpuscles of rye flour, magnified 420 times in diameter. The cross on the granule is that observed through the polariscope. The granules resemble those of wheat starch, but differ from the latter in the smaller ones being much smaller than the lesser wheat starch corpuscles, whilst the larger rye granules often have a three or four-rayed hilum.



Oats.—The engraving shows the structure of the starch corpuscles of the oat, magnified 420 diameters. They are small, many sided, do not show concentric layers, have central depressions, and thickened edges, and occur often in clusters.

Indian Corn.—The starch corpuscles of Indian corn, magnified 420 times, present the appearance shown in the figure. They resemble those of the oat, but differ from them in being detached from each other, in being much larger, and in exhibiting under the polariscope well marked crosses.



Bean.—The starch corpuscles of the bean shown (magnified 420 diameters) in the engraving are kidney-shaped : their hilums are long and divided.

Arrowroot.—In the engraving is shown the appearance presented by maranta or West Indian arrowroot, when magnified 420 times their diameter. They are irregularly ovate, sometimes nearly triangular, are marked by delicate concentric lines, and have at their larger end a circular or valley-like depression or hilum.





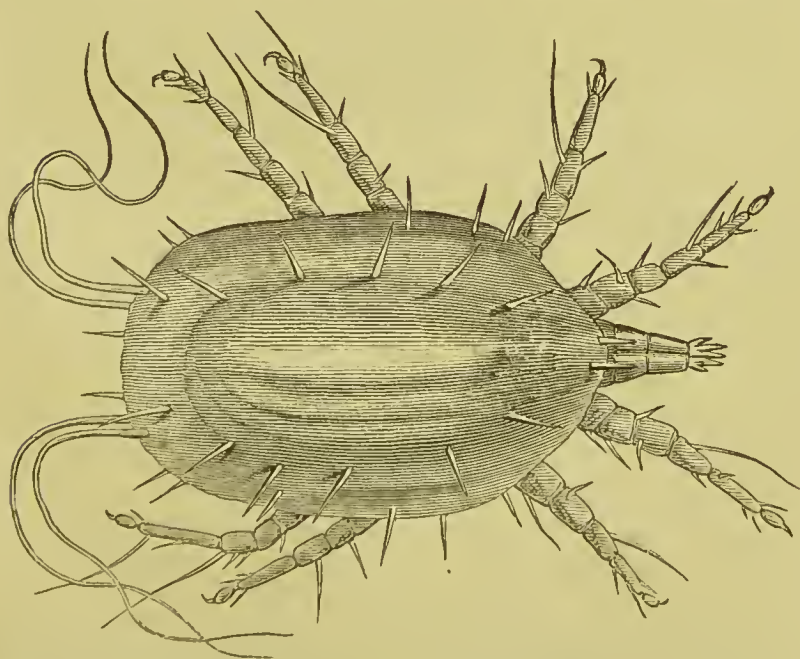
Tous-les-Mois.—This (*Canna*) arrowroot is composed of enormous granules ; mostly flat, ovate, and with hilum at narrow end. Magnified 100 diameters in the engraving.

Tapioca.—This starch (magnified 420 diameters in engraving) occurs in small detached granules, and in groups of corpuscles. They are oblong, but when viewed endways appear circular.



Potato starch occurs in oval, circular, and oyster shapes. The concentric lines are well defined, and the hilum is situated at the narrow end. Under the polariscope the cross is not so regular as in the case of tous-les-mois.

Sugar is generally met with in a pure state. Finzel's "crystals" I find contains $999\frac{1}{2}$ parts per 1,000 of absolutely pure sugar. I



SUGAR MITE, MAGNIFIED ABOUT TWO HUNDRED TIMES LINEAR.

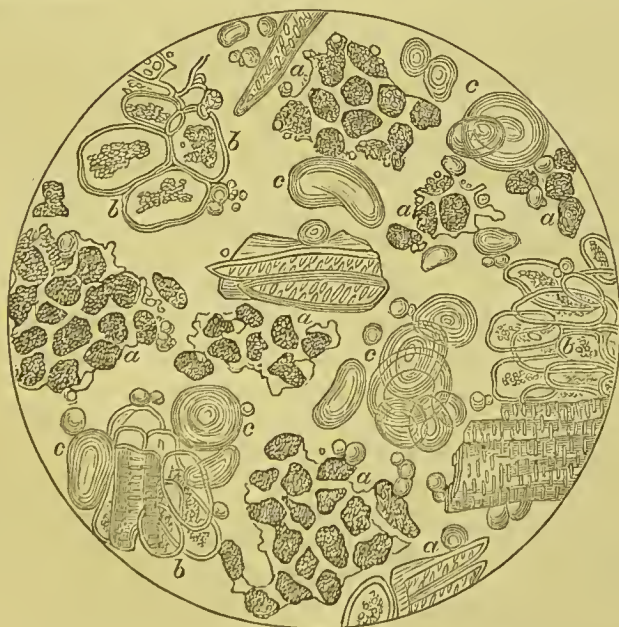
have only met with one case of adulteration, and that was with flour. The sand and clay in raw sugar are only accidentally present, and always in small quantity. Raw sugar contains the spores of plants and various vegetable impurities, and sometimes vast numbers of a species of mite, the *Acarus sacchari*. The low class sugars are often acid, and on the whole it seems best to use filtered sugar, of which high and low qualities are on sale.

Tea.—An extensive botanical knowledge is necessary to enable one to discriminate all the foreign leaves found in tea; if, however, we are familiar with the appearance of the tea leaves, we can at least ascertain whether or not a sample under examination is composed of them. Steep the tea in water, unroll the leaves, place them on thin pieces of glass and examine them with low microscopic power. Tea contains from 3 to 5 per cent. of a crystallisable nitrogenous substance termed thein, about 14 per cent. of albuminous compounds, from 15 to 25 per cent. of tannin, 20 to 30 per cent. of cellulose, and smaller amounts of starch, gum, fats, mineral matter, &c. Hot water should extract at least one-third of its weight from good tea. According to Wanklyn, A. H. Allen, Wigner, Peligo, and Zöller, &c, tea yields from 5 to 6 per cent. of ash, which is mostly soluble in hydrochloric acid. In Assam tea the ash is least soluble; but in other kinds a larger amount of insoluble ash is generally indicative of adulteration. To determine the amount of extractive matter, treat with boiling water, and having dried the exhausted leaves, weigh them. The loss of weight tells the amount of soluble matter, making allowance for the amount of water contained in the leaves. Tea is adulterated with exhausted leaves, rotten leaves (rarely), foreign leaves, and mixed with catechu or some similar substance, gums, dextrin, iron filings, &c. When the watery extract is evaporated to dryness, the mere appearance of the residue often affords a clue to the nature of the sophistication, especially in the case of such gums as catechu. When tea contains less than 30 per cent. of soluble matter it is, in all probability, adulterated, and certainly so when the extractive matter is under 20 per cent.

The colour of green tea is sometimes imparted to it in England by Prussian blue, indigo, and other dyes. The amount is small, and if it do not exceed 0.5 per cent. may be disregarded. In Dublin several thousand pounds weight of tea, composed chiefly of exhausted leaves and catechu, have been destroyed on my certificate by order of the magistrates. Iron filings (to darken the infusion by striking a black hue with the tannin) have been detected in tea. The magnet extracts them from the leaves, and when treated with acid, inflammable hydrogen gas is evolved.

Coffee berries contain from 30 to 40 per cent. of cellulose, 10 or 12 of water, 10 to 12 of fats, about 15 of dextrin, and 1 of caffein. The ash of coffee, according to Allen, averages 4 per cent. of which four-fifths are soluble in water; whilst chicory, which is the common adulterant of coffee, yields 5 per cent. of ash, $3\frac{1}{3}$ parts of which are

soluble in water. Coffee loses by roasting from 15 to 25 (generally 18) per cent. of its weight, and becomes lighter. Its sugar varies from 1 to 6 per cent.; sometimes it is absent. Hot water extracts from 20 to 35 per cent. of soluble matter from roasted coffee. Coffee is adulterated with chicory, burnt sugar, and biscuits, roasted grains of different kinds, mangel wurtzel, malt, spent tan, iron rust, earthy matters, &c. The only adulterants which I have met with were chicory (in most samples), burnt sugar, farina of different grains, and earthy matters. As starch never occurs in pure coffee, the microscope readily detects that adulteration. Chicory is easily discovered by the same means, owing to the circumstance that when it is present abundance of vasa laticentia, and dotted or barred ducts are observable. The cells of mangel wurtzel, carrot, and parsnip resemble chicory. The examiner should familiarize himself with the microscopic appearance of these substances, unmixed, and mixed with coffee. A rather weak tincture of iodine added to coffee causes any starch granules it may contain to become deep blue. A few grains of coffee placed on water remain for some time before sinking into the fluid, but if chicory or caramel (burnt sugar) be present, they sink at once and colour the water. The amount of chicory may be determined by the microscope, and examination of soluble portion of ash. Sugar may be estimated by the copper method in the usual manner. Chicory contains nothing which warrants its use as a food or stimulant; and as it is very astringent, its constant use may, in some cases, prove injurious.



(a) coffee (b) chicory (c) wheat starch.

The engraving shows the microscopic appearance presented by coffee adulterated with chicory and roasted wheat flour. The dotted

or barred spiral vessels, so abundant in the chicory, do not occur in coffee, and, therefore, their presence in coffee indicates adulteration by chicory. The starch granules of wheat or other grain are also readily detected by the microscope, especially when coloured blue by the application of dilute tincture of iodine.

Cocoa often contains about 50 per cent. of fats, and 20 per cent. of albuminoids; and it includes (as stated) from a trace to 19 per cent. of starch. The high proportion of starch may have been found in adulterated cocoas. The analyses of this substance published are very discordant, except with respect to the fat, which varies from 44 to 52 per cent. Foreign starches may be detected by the microscope. As there is no sugar, or, at most, a trace, in cocoa, this substance, when present, is added. Sugar and farina are generally mixed with cocoa to form chocolate. Flake cocoa consists of nibs and shells ground together.

"Soluble" cocoa is generally prepared by abstracting fat from the nibs, and replacing it by farina and sugar. Wanklyn says that good cocoa nibs ought to yield to cold water 9 per cent. of its weight. A mixture of chicory and cocoa gives a deep coloured, and cocoa alone a pale, infusion. Cocoa leaves from 3 to $4\frac{1}{2}$ per cent. of ash after its combustion.

Confections.—During the year 1870 I made an examination of 123 specimens of sugar confectionary. Those manufactured at three establishments were quite pure: the collections obtained at ten other shops contained poisonous pigments and other impurities in a large proportion of the items.

Out of 40 confections coloured yellow, only 2 owed their hue to saffron. One was coloured with gamboge; and all the others were coated with chromate of lead, or plumbic chromate, commonly termed chrome yellow. The amount of the latter pigment varied from $\frac{1}{400}$ th to less than $\frac{1}{1000}$ th of the weight of the confections. The common sugarstick sold at $1\frac{1}{2}$ d. per two ounces contained the largest proportion of chromate of lead. 12 articles—chiefly lozenges and "sugar almonds"—had a bright orange hue, due to the presence of a variety of chromate of lead. 38 of the specimens—comprising "peaches," sugar almonds, lozenges, comfits, sugarstick, sugar balls, &c.—had various shades of red, from a faint pink to a bright scarlet. Of these, 36 specimens were coloured with cochineal, 2 contained vermilion (mercuric sulphide, or bisulphide of mercury) in the proportion of 4 grains per ounce of the confection—which was the cheapest kind of sugarstick.

At one time arsenite of copper was frequently used to impart a brilliant green colour to confectionary; but the numerous accidents which occurred from the employment of this poisonous pigment have so alarmed the public that green confectionary is now scarcely to be met with. Only one of the specimens examined by me was coloured green, and that was only a small figure of a baby, with a green frock on it. The colour was composed of a mixture of Prussian blue and chromate of lead.

Blue is not a popular colour ; only one specimen having streaks of this colour was contained in the 123 samples. The pigment employed was ultramarine. 9 specimens were brilliantly coloured with mauve, magenta, &c.

As the coal-tar dyes are liable to contain traces of lead, mercury, and arsenic, and as their use for the purpose of colouring confectionary has been prohibited by the authorities in Paris, it would appear to be the safer plan not to place these dyes on any substance intended for human food. The quantity used is, however, so small that no serious consequences are likely to arise from eating confections coloured with these substances.

An article of food containing more than a grain of chromate of lead per ounce may well be regarded as a slow poison. Soft water containing less than $\cdot 1$ grain of lead per gallon (70,000 grains weight) has often produced poisonous effects on individuals and families. Chromium (an ingredient of chromate of lead) is also a poisonous metal. Six grains of a salt of this metal injected into the jugular vein of a dog caused the death of the animal. Workmen engaged in the preparation of chromate of potash (potassic anhydro-chromate) often suffer from an ulceration of the throat resembling that of secondary syphilis ; and also from slow necrosis of the nasal bones. I have not the slightest doubt but that the use of confectionary coloured with chromate of lead produces a large amount of infantile disease.

Vermillion was at one time an officinal medicament ; but it is no longer administered internally, though still employed in mercurial fumigations. It constituted the basis of Boerhaave's red pill—a celebrated nostrum of former days. There is a general belief in the inertness of this salt of mercury ; but I find that it is capable of producing mercurialism, when given in very large doses. In $1\frac{1}{2}$ d. worth (2 oz.) of sugarstick I found 8 grains of this salt. As the dose of calomel—one of the mildest compounds of mercury—for a young child is only a grain, it is evident that vermillion, notwithstanding its great insolubility and comparative inertness, if consumed by a child at the rate of even 2 or 3 grains per diem, would produce some ill result. My friend Dr. Benjamin F. M'Dowell kindly tried the effects of vermillion on some of his patients at the Lock Hospital, and the following are the results arrived at :—

I have employed the persulphide of mercury, or “vermillion,” in a number of cases since November last, with a view to ascertain whether or not it is “inert,” and also to discover if any special therapeutic action might be assigned to it.

In all the cases selected mercurial treatment was indicated.

In several of them I was not able to pursue my observations sufficiently long to form an opinion as to its action in continued doses. I give a sketch of the particulars of three which are carefully recorded. In small single doses it produces no apparent effect.

On the 30th November, having first ordered an aperient for each, I directed for three of my patients this drug in doses of four grains three times a day, with sugar.

2nd December.—None of the patients complained of any unusual symptom or sensation, except headache, but as this is a manifestation which often follows the use of other mercurial preparations, I attached no importance to it; accordingly they were all directed to have double the previous dose, that is, twenty-four grains per diem.

8th December.—One of the patients left the hospital, and so I could not pursue the inquiry any further in her case; but neither she nor the other two complained of any abnormal sensations, except slight headaches and griping pains in the abdomen—in one of the cases there was, I thought, slight mercurial fœtor from the breath, but it was badly defined.

14th December.—Gums are vascular, evidently tender in one case, and there is a faint mercurial fœtor from the breath; in the other, who is pregnant, there is no mercurial fœtor, and the gums are not at all tender—the latter, however, are somewhat vascularized.

December 14th to 26th.—There was a gradual development of symptoms of mercurial saturation in the case of the pregnant woman, less marked than in the other case.

26th.—The medicine was discontinued in each case.

January 10th.—The gums of each of the patients are still tender; this is remarkable; but there has been no salivation in either case, either during the use of the drug or since.

16th January.—Gums still very tender, yielding blood at the slightest touch. The characteristic blue hue is very apparent. The vermilion used was examined by Dr. Cameron and found to be pure. The patients to whom the salt was administered were visited by him.

Remarks.—The case in which the medicine was discontinued on the 8th December had taken about one hundred and eighty grains without any prominent symptom; the other two took in all about six hundred grains each—in both these cases the usual symptoms produced by a mercurial course manifested themselves; in the one case no doubt less prominently than in the other, for obvious reasons.

The history of the treatment of these cases clearly proves that the usual symptoms produced by the other preparations of mercury in repeated doses will follow the use of this drug.¹ I am not inclined to attach any special importance to it as a mercurial agent; on the contrary, I believe it to be slow and uncertain in its action.

I have used it in the form of fumigation in putrid ulceration of the throat some years ago in the Lock Hospital, but I found it difficult to regulate its action, and it produced irritation of the air passages. The application of a simple solution of sulphurous acid, or the spray into which it is converted, is better, and other mercurials are more convenient where fumigating treatment is called for.

Regarded in a hygienic point of view, I believe the continued use of small doses would act injuriously on the constitution.

Vermillion is very liable to be adulterated. The Chinese vermilion is generally very pure; but cheaper varieties frequently contain minium, or red lead—an oxide of lead. In the vermilion used to colour the confectionary which came into my possession, I found nearly 20 per cent. of red lead—a far more active poison than mercuric sulphide.

Lozenges purchased at two of the thirteen sugar confectioners' shops contained from 12 to 40 per cent. of an insoluble white clay, known in the trade under the term of *terra alba*. The peaches, sugar almonds, lozenges, and comfits contained rice starch and gum arabic. Cough lozenges and bath pipe contained gum, sugar,

¹ The after effects of the salt appeared to be more decided than those produced by the ordinary mercurial compounds; it would seem as if it were longer retained in the system.

and extract of liquorice—a few of them being slightly medicated by the addition of opium and camphor (probably in the form of paregoric elixir). Small quantities (under 3 per cent.) of plaster of Paris were found in the bath pipe and cough lozenges; but they were probably derived from adulterated liquorice extract.

A figure of a baby in its cradle had the following composition:—The cradle was composed of a mixture of plaster of Paris (calcic sulphate) and sugar; the body of the baby was sugar and rice starch; its eyes were Prussian blue; its cheeks were tinted with cochineal; and its dress was painted with chromate of lead.

The ten sugar confectioners above mentioned, whose wares I have now described, were prosecuted before the police magistrates. Five of them on paying costs (£3), and promising to abandon the use of poisonous pigments, were “let off with a caution;” the others were fined respectively £5, and £3 costs; £1, and £1 costs; £1, and £1 costs; 10s., and £3 costs; and 10s.

In analysing confectionery for the purposes of a prosecution the methods of procedure must be very accurate. One may, however, readily determine the presence of impurities in the following manner:—Dissolve a little of the article in water; if vermilion be present it rapidly sinks to the bottom of the vessel, whilst cochineal remains in solution. Add a few drops of solution of chloride of lime and the cochineal colour instantly vanishes. Chromate of lead forms an opaque colour, whilst saffron is more or less transparent. Rub off the colouring matter, and heat it to redness in any convenient crucible or capsule. A dirty green or yellowish green residue indicates that chromate of lead had been used. To be certain on this point, dissolve the residue in a few drops of pure nitric acid, heat gently to drive off the excess of acid, add a little water, and test for lead. Solution of ammoniac sulphide (hydro-sulphate of ammonia) gives a dark brown precipitate, and solution of potassic iodide a bright yellow precipitate. These operations may be conducted on the most minute scale. The coal-tar colours are so remarkable that the eye can hardly fail to recognize them.

Incinerate in any convenient vessel 100 grains of the confection. If pure, no residue should be obtained. China clay remains as a grayish, heavy powder insoluble in acids; gypsum as a grayish residue soluble in hydrochloric acid.

In conclusion, I think it would be desirable to limit the colours used by confectioners to three—namely, cochineal (or carmine); saffron; and, for opaque yellows, Madras turmeric.

Butter when it contains more than 12 per cent. of water or 10 per cent. of salt is clearly adulterated. It is, but not often, adulterated with foreign fats, the detection of which is difficult. Dr. Hassall, in his evidence before the Committee of the House of Commons on adulteration, 1874, states (page 307 of Committee's Report) that his assistant and a pupil (Messrs. Hehner and Angell) have devised a method of detection of foreign fats, the principles of which are as follows:—

All fats are the glycerides of the three fatty acids, stearic, palmitic, and oleic; butter, however, in addition to these, contains butyric, caproic, caprylic, and capric acids. The quantities of the latter volatile and soluble acids have hitherto been stated to be very small, below 2 per cent.; our researches show clearly that butter invariably contains 10 per cent. of the glycerides of these acids. If an estimation of the insoluble fatty acids in any fat, except butter, be made, 95.5 per cent. is obtained; on the contrary, butter yields only 85.5 per cent. An adulterated butter, therefore, will give a quantity lying between these two numbers, varying in ratio to the percentage of adulteration, which may thus be accurately calculated.

As a corroboration, we make use of a new method of taking the fusing point of the butter, which is based upon the principle that a float placed on the top of the butter will invariably sink at the same temperature if it be genuine. By this means small quantities of foreign fats, having a high fusing point, can be discovered. As instances of the accuracy of these two methods we give the following figures:—

Percentages of fixed acids in pure butter fat:

No. 1	...	85.57	No. 4	...	85.48
„ 2	...	85.71	„ 5	...	85.84
„ 3	...	85.56	„ 6	...	85.40

Fusing point, as indicated by float:

No. 1.	...	36.5°C.	No. 4	...	36.0°C
„ 2	...	37.0	„ 5	...	36.4
„ 3	...	37.0	„ 6	...	36.4

Mr. Wanklyn in his evidence before the same committee stated that he could prepare admixtures of fats with butter which Dr. Hassall could not analyse. Dr. Parkes has shown the melting points of different fats, as follows:

Temperature of Melting and Solidifying.

	Fusion.		Solidification.	
	Commencing.	Completed.	Commencing.	Complete.
Butter	65°-68°	80°-90°	70°-80°	60°-82°
Lard	76°-80°	100°-115°	90°-100°	71°-75°
Beef dripping	68°-85°	100°-120°	90°-100°	72°-76°
Mutton dripping	86°-100°	140°-150°	120°-130°	86°-92°
Palm oil	81°-92°	110	88°	69°

He has also shown the solubility of those fats.

	Complete Solution.	Deposit on Cooling.
Butter oil	70°-75°	63°-58°
Lard	90°-105°	90°
Beef dripping	72°-74°	64°-62°
Mutton dripping	95°-100°	90°

Dr. Campbell Brown, of Liverpool, has suggested that the melting points of fats might be used as a means of discriminating some of the adulterations of butter. The lowest point at which stearin melts is 120 degrees.

Mr. Horsley says (*Chemical News*, 11th September, 1874) that if 25 grains of butter be dissolved in one drachm of methylated ether—specific gravity, 730°—at 65° F. no precipitate will be produced in the solution by the admixture of 20 drops of methylated spirit, 53° over proof; whereas if a mixture of butter and tallow, or lard, be so treated, the latter will, in half an hour, separate from the ether, and may be collected and weighed.

Cheese contains from 30 to 40 per cent. of water, from 20 to 30 per cent. of fats, 24 to 26 per cent. of casein, and 4 to 7 per cent. of ash. It is frequently coloured by annato. Starch has been detected in cheese; so also has zinc, derived from the vessels used in the preparation of the article.

Mustard is mixed with wheat and rice flour, rendered more pungent by Cayenne pepper, and coloured with turmeric; the foreign matters are readily detected by the microscope. The intense yellow colour of the turmeric, and the reddish hue which



The engraving shows the appearance presented by mustard (a), turmeric (c), and cayenne (d). The appearance of the starches has already been shown in pages 306 and 307.

it assumes when moistened with potash solution, enables it to be easily detected. The grains of red pepper frequently mixed with mustard can be seen through the microscope. Before the passing, in 1872, of the act relating to adulteration, mustard was rarely

sold pure; but now it is generally sold either unmixed with farina, or if mixed, the fact is so stated on the label. I have found plaster of Paris in mustard; but in future such an adulteration is not likely to occur in these countries.

Pepper is adulterated with mustard husks, rice, linsced, and rape-seed cakes, wheat, and pea flour. These adulterations may be detected by comparing the microscopic appearances of the articles named with those presented by a specimen of genuine pepper. Cayenne pepper, in addition to the adulterants mentioned above, has been found to contain ochre, vermillion, red lead, and salt, all of which are readily detectable by the ordinary methods of analysis. Out of 28 samples of Cayenne pepper examined by Hassall, 24 were adulterated; but at that time there was no anti-adulteration law in force.

Milk consists of a mixture of fatty and albuminous bodies, with a peculiar kind of sugar (lactin), and certain saline substances, of which the alkaline chlorides are the most abundant. The colour of milk is said to be due to its being an emulsion of fats with an albuminous liquid; but I have found it to be produced by the reflection of light from the numerous solid caseous envelopes in which the fats are enclosed. By prolonged digestion of milk with chloroform or anhydrous ether, at a temperature lower than that at which the casein coagulates, all the fats can be extracted from it, leaving still a perfectly white and milk-like liquid. The results of several thousands of analyses convince me that the mixed milk of a herd of cows never contains less than 12 per cent. of solid matters. I have in general found the milk of town dairy cows richer than that of cows in the country, probably because the former are better fed. Wanklyn (who has made the examination of milk a special study) states that the milk of cows contains, as a constant quantity, 9·3 per cent. of solid matters, *minus* fats. In general I find pure town milk to contain from 12·5 to 14·5 per cent. of solids. I frequently receive milk for examination in which the solids exceed 14 per cent. The average amount of solids in the milk from the Dublin dairies is fully 13 per cent., as the results of hundreds of analyses have proved to my satisfaction. Milk contains about:—Water, 87; fats (butter), 4; casein (cheesy matters), 4·1; sugar, 4·3; mineral matter, 6=100.

The specific gravity of milk varies from 1·026 to 1·030. One hundred parts placed in a tube throw up after some hours from 7 to 14 parts of cream. The determination of the purity of milk by its percentage of cream is, therefore, unreliable, though as a rule good milk throws up about 9 per cent. of cream. Neither is specific gravity a sure test as to its quality; for though milk adulterated with water has a low specific gravity, yet that which is both skimmed and diluted with water has a high specific gravity. The larger the amount of fats in milk the lower is its specific gravity; therefore the withdrawal of cream from this liquid increases its specific gravity.

Milk may be examined as follows:—Evaporate on the water-bath 100 grains or 5 or 10 grammes to dryness in a flat platinum dish (a porcelain one answers, if the solids only are to be determined), and weigh. If the residue amount to 12 per cent., the milk may be regarded as pure; if the solids be 6 per cent., then to the original, or pure milk its own weight of water must have been added. A drop of acetic acid added to the milk prevents the formation of a crust during its evaporation. The fats are determined by boiling the residue in strong methylated ether for two hours. This is done in a small flask, and the ether is prevented from escaping by fixing, by means of a cork in the mouth of the flask, a glass tube 4 feet in length. The ether condenses in the tube and falls back into the flask. The ethereal solution of the fats is filtered, the residue washed with a little hot ether, and the solution and washings evaporated to dryness in a dish; the residue is the fat, and is weighed in the usual manner.

The amount of sugar may be determined as follows:—34.64 grammes of pure and dry crystallised sulphate of copper are dissolved in 200 cubic centimetres of distilled water, and mixed with 173 grammes of pure crystallized Rochelle salts, dissolved in 480 c. c. of solution of pure caustic soda, of specific gravity 1.14. The mixed solutions are made up to a litre with distilled water. 1 e. c. of this solution contains 0.3464 gramme of sulphate of copper, and equals 0.005 gramme of anhydrous grape sugar, or 0.00666 gramme of lactin. To use this solution, take 10 e. c. of milk, add a few drops of acetic acid, heat gently, and filter, to separate casein and some of the fat. Dilute the filtrate with 9 parts (by volume) of water, so that one litre of the liquid may contain the milk sugar of 100 c. c. of milk. Next place a measured quantity of the copper solution in a flask or white capsule diluted with four times its volume of water, and heat to the boiling point. Drop the acidulated milk from a burette into the boiling solution; red oxide of copper is produced, but the solution remains blue; continue to drop the milk solution until the blue colour disappears. Whether or not the copper is fully reduced from cupric to cuprous oxide can be determined by the addition of a drop of solution of ferrocyanide of potassium, which produces a rich brown precipitate with cupric oxide. A simple rule of three sum will determine the amount of sugar, from the quantity of copper solution used up per e. c. of the milk solution. The casein is determined by burning the substance left after extraction of the fats by the ¹soda-lime process. It may also be determined by difference, or, but not very accurately, by the following method:—Boil 10 grammes of milk slightly acidulated with acetic acid, dilute largely

¹ Nitrogenous substances mixed with soda and lime when burned in a glass tube in the organic analysis furnace have their nitrogen converted into ammonia: 17 parts of ammonia equal 14 parts of nitrogen; and 6 parts of nitrogen = $6\frac{1}{2}$ parts of albuminous substances.—*Vide* works on organic analysis.

with boiling water, and allow the liquid to stand for 24 hours; wash the precipitate which will have formed in the interim with ether at 80° Fah.; dry and weigh. Wanklyn dilutes milk with 99 volumes of water, and distils 5 c. c. of the diluted liquid with 10 grammes of potash and 0.4 gramme of permanganate of potassium, according to the method for determining the amount of albuminoid nitrogen in water (see page 63). The potash and permanganate are boiled with half a litre of water in the retort, and the distillate tested from time to time for ammonia. When none is found the milk is introduced through the tubulure, and the ammonia which distils over is collected (in pure water), and estimated by the Nessler test, as already explained. One part, by weight, of casein is equal to 0.065 parts of ammonia.

The ash (mineral part) of milk is found by burning the residue obtained by evaporating 10 grammes of the liquid to dryness; the combustion should take place at a low temperature, and in a platinum dish, placed over a colourless flame. Pure milk leaves from 55 to 72 per cent. of ash.

In a specimen of milk which I examined for Mill-street Union, County of Cork, I found one per cent. of chalk, which, probably, had been added to neutralise the acidity of milk kept too long. The article, however, was adulterated with 33 per cent. of water. In two other cases I found cane sugar in milk. These three instances of adulteration of milk with substances other than water are all that have come under my notice.

Condensed milk is prepared by evaporating the liquid in vacuo nearly to dryness, and adding sugar to the extract. In order to make the extract keep better, I think the milk is sometimes deprived of a portion of its cream, which latter article is then converted into butter. I found the composition of two specimens of condensed milk to be as follows: 100 parts of each contained:—

		Aylesbury.	Anglo-Swiss.
Water	...	22.52	20.25
Fats	...	8.60	7.23
Casein	...	11.50	10.00
Sugar	...	55.38	60.44
Ash	...	2.00	2.08
		<hr/> 100.00 <hr/>	<hr/> 100.00 <hr/>

If pure milk can be procured at 1s. 4d. per gallon, it is more economical than condensed milk at the price at which the latter is vended; but condensed milk is sometimes a cheaper article than the well-watered milk so generally sold in cities.

Whiskey.—In several hundred specimens of whiskey which I have examined, not one was seriously adulterated. I never detected bluestone (sulphate of copper), which is popularly supposed to be used as an adulterant, but in two instances I found a

faint trace of copper, evidently derived from the copper vessel from which the spirit had been distilled. I have found spirits of nitrous ether in two or three cases, also extract of orris root, prunes, &c., sugar and other matters, added in very small quantities, and apparently for the purpose of flavouring and colouring the article. Much of the whiskey sold is, however, unfit for use on account of its freshness. When whiskey is first prepared it contains certain matters, especially fusel oil (amylic alcohol), which render it undrinkable. If these matters be removed by rectification, the whiskey is converted into spirits of wine, which, though pure, is unpalatable. On the other hand, if the whiskey be kept for three or four years in wood, the matters which when fresh render it objectionable, disappear; and the whiskey acquires a fine flavour and odour. The changes which occur during the storing of whiskey in wood are not thoroughly known. It is stated that the amylic alcohol—which undoubtedly is a most unpleasant and injurious ingredient of new whiskey—is oxidised by time into fragrant and well flavoured products, which confer upon old whiskey its characteristic properties. Although amyl ether is fragrant, there is no evidence that it is produced from its alcohol in whiskey; and most of the other derivatives of amylic alcohol have neither a pleasant odour nor flavour. Probably there is in new whiskey small quantities of many substances, some of which have a disagreeable odour and flavour; others the converse. In process of time, the former, being more volatile, escape, leaving the latter. When the nature of the bodies which confer upon the stronger alcoholic liquors their characteristic properties becomes known, they will probably be found to include several aldehyds, ketones, and ethers beside those derived from ethylic alcohol. The whiskey from the Johnston patent still is said to be fit for use the moment it is made; a statement I am inclined to believe, judging from the samples which I have examined. Unless in the case of whiskey of this kind, all that is made should not be permitted by the government to be removed from bond until it is two years old. The ill effects attributed to adulterated whiskey are really due to new whiskey.

In the Isle of Man there is a law in force which proscribes under a penalty the sale of spirits which have not the strength of 11° under proof, unless the amount of alcohol is indicated to the purchaser. In Ireland much of the whiskey is diluted to a scandalous extent with water. I have found it from 30° to 52° under proof. Much of the whiskey supplied to the public institutions is from 20° to 30° U.P. The amount of alcohol in whiskey, and in other liquids, may be determined as follows:—Distil a few ounces nearly to dryness, and make up the distillate to the bulk of the original quantity of spirit. Reduce the temperature of the liquid by the external application of ice and salt, or increase it, if necessary, by warm water placed round the vessel containing it, until its temperature is 60° Fah. Take its specific gravity by weighing it in the Sp. G. bottle, or by floating an alcohometre in it.

Table showing the amount of Alcohol, by volume, in mixtures of alcohol and water, at 60° Fahrenheit. Water at its maximum density is taken as the standard for the average gravity, and is set down as 1.0000, which at 60° Fah. equals .9991.

Per cent. of alcohol, by volume.	Spec. grav. of the liquid at 60 degs.	Per cent. of alcohol, by volume.	Spec. grav. of the liquid at 60 degs.	Per cent. of alcohol, by volume.	Spec. grav. of the liquid at 60 degs.
0	0.9991	84	9596	68	8941
1	9976	35	9583	69	8917
2	9961	36	9570	70	8892
3	9947	37	9556	17	8867
4	9933	38	9541	72	8842
5	9919	39	9526	73	8817
6	9906	40	9510	74	8791
7	9893	41	9494	75	8765
8	9881	42	9478	76	8739
9	9869	43	9461	77	8712
10	9857	44	9444	78	8685
11	9845	45	9427	79	8658
12	9834	46	9409	80	8631
13	9823	47	9391	81	8603
14	9812	48	9373	82	8575
15	9802	49	9354	83	8547
16	9791	50	9335	84	8518
17	9781	51	9315	85	8488
18	9771	52	0.9295	86	8458
19	9761	53	9275	87	8428
20	9751	54	9254	88	8397
21	9741	55	9234	89	8365
22	9731	56	9213	90	8332
23	9720	57	9192	91	8299
24	9710	58	9170	92	8265
25	9700	59	9148	93	8230
26	9689	60	9126	94	8194
27	9679	61	9104	95	8157
28	9668	62	9082	96	8118
29	9657	63	9059	97	8077
30	9646	64	9036	98	8034
31	9634	65	9013	99	7988
32	9622	66	8989	100	7939
33	9609	67	8965		

Table showing the degrees Over and Under Proof in mixtures of Alcohol and Water.

Specific Gravity.	Degrees Over Proof.	Specific Gravity.	Degrees Over Proof.	Specific Gravity.	Degrees Proof.	Specific Gravity.	Degrees Under Proof.	Specific Gravity.	Degrees Under Proof.
8156	67°	8737	34.1	9174	2.1	9492	26.7	9730	59.7
8174	66.1	8751	33.2	9185	1.3	9496	27.1	9738	61.11
8129	65°	8765	32.2	9189	1°	9503	28°	9746	62.5
8221	64°	8776	31.5	9196	0.3	9511	28.8	9750	63.2
8238	63.1	8783	31°	9200	proof	9519	29.7	9758	64.6
8259	62°	8790	30.5		under proof	9526	30.6	9762	65.3
8277	61.1	8800	29.8	9210	.9	9530	31°	9770	66.7
8298	60°	8811	29°	9218	1.6	9534	31.4	9774	67.4
8315	59.1	8825	28°	9226	2.2	9542	32.3	9778	68°
8336	58°	8840	27°	9237	3.1	9557	34.2	9786	69.4
8354	57.1	8854	26°	9248	4°	9565	35.1	9794	70.8
8376	56°	8869	25°	9259	5°	9573	36.1	9802	72.1
8395	55°	8883	24°	9270	6°	9580	37.1	9810	73.5
8413	54.1	8897	23°	9282	7°	9588	38.1	9822	75.4
8431	53.1	8912	21.9	9295	8°	9596	39.1	9830	76.7
8448	52.1	8926	20.9	9306	9°	9603	40.1	9838	78°
8465	51.1	8937	20.1	9318	10°	9611	44.1	9846	79.2
8482	50.1	8951	19.1	9329	11°	9619	42.2	9854	80.4
8499	49.1	8966	18°	9341	12.1	9627	43.3	9862	81.7
8516	48°	8977	17.2	9353	13.1	9631	43.9	9870	82.9
8523	47°	8992	16.1	9364	14.2	9638	45°	9878	84
8550	46°	9008	15°	9372	14.9	9.46	46.1	9886	85.2
8566	45°	9019	14.2	9384	16°	9654	47.3	9894	86.3
8583	43.9	9034	13.1	9396	17.1	9661	48.5	9902	87.4
8597	43.1	9049	12°	9407	18.2	9669	49.7	9914	89.1
8615	42°	9060	11.1	9415	18.9	9674	50.3	9922	90.2
8629	41.1	9075	10	9426	20°	9677	51°	9934	91.7
8646	40°	9089	8.9	9434	20.8	9685	52.2	9946	93.3
8660	39.1	9100	8°	9445	21.9	9693	53.3	9958	94.9
8678	38°	9111	7.1	9452	22.7	9697	54.2	9974	96.8
8692	37.1	9122	6.2	9460	23.5	9705	55.5	9986	98.2
8706	36.2	9137	5°	9468	24.3	9709	56.2	9993	99.1
8716	35.5	9152	3.9	9476	25.1	9713	56.9	1000	100°
8723	35°	9163	3°	9484	25.9	9722	58.3		

The percentage of alcohol in different liquids is shown in the following table:—

Percentage of Alcohol.			Percentage of Alcohol.		
Rum	...	60 to 75	Chablis and Sauterne	...	8 to 12
Whiskey	...	54 „ 60	Rhine wines	...	7 „ 15
Brandy (British)	...	50 „ 60	Champagne	...	7 „ 13
French brandy	...	50 „ 55	Burgundy	...	8 „ 12
Gin	...	48 „ 58	Moselle	...	8 „ 13
Port wine	...	14 „ 24	Ale	...	6 „ 9
Sherry wine	...	14 „ 27	Cider	...	5 „ 9
Roussillon	...	11 „ 16	Porter	...	4 „ 4
Claret	...	9 „ 14	Beer	...	2 „ 7
Hungarian wines	...	9 „ 15			

In examining wine three ounces may be used and two distilled. Half the quantity of beer need only be distilled. Neutralize the free acid in the liquor before distilling.

Gin is spirit of wine flavoured with juniper berries, coriander seeds, grains of paradise, &c. I think it is rarely adulterated with any injurious substance.

Brandy is often adulterated with corn spirit, and, therefore, frequently contains fusel oil. It is generally mixed with a little syrup.

Rum is adulterated with corn spirit and molasses. Its flavour is said to be chiefly due to butyric ether.

Wines.—I am disposed to think that wines are not much adulterated. Different varieties and qualities of wine are mixed (“blended”); but that can hardly be regarded as a falsification. Claret, I have no hesitation in asserting, is exceedingly rarely adulterated, even when it is sold at a shilling per bottle. The quality of wine is, however, often very bad. Port and sherry contain a large amount of added alcohol; but everyone knows this. The examination of wine is usually limited to ascertaining the amount of alcohol, acid, sugar, and extractive which it contains. The acidity of wines and other liquids may be determined as follow:—Dissolve 63 grammes of crystallized oxalic acid in one litre of water. A solution of caustic soda is graduated with this acid solution, so that 1 c. c. of the one exactly neutralizes 1 c. c. of the other. In preparing the standard solution of soda, if, say, 7 cubic centimetres of the preliminary solution neutralize 10 c. c. of the acid solution, then add 30 per cent. of water to the alkaline solution. One c. c. of alkaline solution equals .0051 gramme of anhydrous and .006 gramme of glacial acetic acid, .0192 gramme citric acid, .015 gramme tartaric acid, and .0049 gramme oil of vitriol. The amount of acidity is ascertained by distilling a portion of the wine (if the colour be high), making up the distillate to the original volume of the liquid used. Ten c. c. of the liquid are then taken, and the alkaline solution dropped into it until neutralization takes place. The number of c. c. used, mul-

multiplied by the co-efficient of say glacial acetic acid, gives the total amount of acidity in the quantity of wine operated on. By a simple calculation the amount per ounce or pint may next be ascertained. The point of neutralization is ascertained by colouring the liquid to be tested with litmus. The acid reddens this reagent; but so soon as the acid is neutralized the litmus re-acquires its blue hue. There are several acids in wine; but it will be sufficient to estimate all as tartaric. The amount of solid matter is determined as in the case of milk. Sugar may be estimated by the copper solution.

Wines contain variable quantities of fruit sugar, albuminous bodies, vegetable acids, and other matters. The sugar varies from a mere trace to 25 grains per ounce of 480 grains. Mazanilla and Amontillado contain only from 1 to 8 grains per ounce; Marsala and Madeira, 3 to 35 grains; Port, 15 to 35 grains; Champagne, from 10 to 40 (average about 28) grains. Sugar is added to sparkling Champagne and Moselle. In Claret, Burgundy, and Hock there is little or no sugar. According to Bence Jones, wines stand, with respect to acidity, in the following order, those most acid being placed first:—Sherry, Port, Champagne, Claret, Madeira, Burgundy, Rhine wine, Moselle. The albuminous matters in wine are unimportant. The flavour and odour are in great part due to peculiar substances termed compound æthers, of which there appear to exist a large number. The salts consist of cream of tartar and other compounds of potassium, tartrate of lime (calcic tartrate), salt, and some other matters, making in all about 1 grain per ounce of wine. The matter obtained by evaporating an ounce of wine to dryness weighs from 15 to 50 grains.

The free acid amounts to from 2 to 4 grains per ounce in Claret, $1\frac{1}{2}$ to 3 grains in Sherry, 2 to 4 grains in Port, 1 to 4 grains in Rhine wines, and two to four grains in Champagne. Larger quantities than these injure the quality of the wine very seriously, and much larger amounts—6 or 8 grains per ounce—utterly spoil them.

The spirit distilled from wine when rubbed on the hand exhales the odour of whiskey or other corn spirit, elder berries, &c., if any of the latter substances had been used as adulterants. When to wine is added one-fourth of its bulk of a strong solution of alum, and, secondly, an equal volume of strong solution of carbonate of ammonium, a red or purplish colour is produced if logwood, Brazil wood, elder berries, and some other substances be present, but if not, the wine acquires a dirty greenish hue. Alum, lead, and copper may be detected by evaporating two ounces of the wine to dryness, burning the residue, and examining the ash for these substances, according to the method already described, p. 86.

Beer.—I have only met with one case of adulterated porter. In England it is said that beer is adulterated with salt, grains of paradise, burnt sugar, alum, cocculus indicus, lime, soda, metallic salts, and various other matters. The extract obtained by evapo-

rating beer, if closely examined and tested, reveals the presence of some of these adulterants. *Cocculus indicus* appears to be rather a frequently used adulterant. Herepath gives the following mode of detecting its active principle, picrotoxin:—Treat the beer with solution of sugar of lead, filter, precipitate the lead with sulphuretted hydrogen, concentrate to a small volume, and filter the liquid through animal charcoal. The picrotoxin is retained by the charcoal, from which, when dried, boiling alcohol extracts it and from the alcohol it may be obtained in tufts of crystals by evaporation in a little watch glass.

Picrotoxin when treated successively with 3 or 4 parts of pure nitre, a drop or two of sulphuric acid, and an excess of solution of caustic potash, produces a bright yellow colour; solution of picrotoxin in sulphuric acid gives, when touched with bichromate of potassium, a violet hue, which soon changes into brown and green.

Vinegar is, according to law, allowed to contain .1 part per 1,000 of sulphuric acid. A larger proportion may be detected by the soda solution, when the acetic acid has been expelled by boiling. *Vinegar* should contain at least 4 per cent. of acetic acid.

TABLE
Of Decimal Weights and Measures, and their Equivalents.

1 Mètre	=	39.37079 inches
1 Décimètre	=	3.937079 „
1 Centimètre	=	0.3937079 „
1 Millimètre	=	0.03937079 „
1 Cubic centimètre	=	0.061024 cubic inches
1 Litre	=	35.2754 fluid ounces
1 Milligramme	=	0.015432 grain
1 Centigramme	=	0.154323 „
1 Decigramme	=	1.543234 grains
1 Gramme	=	15.432348 „
1 Killogramme	=	15432.348 „

A gramme weighs 1 cubic centimètre of distilled water at 4° centigrade, or 39.2° Fahr.; but in working with test solutions, it is better to have the cubic centimètre equal to 1 gramme at 60° Fahr., the most usual temperature in the laboratory.

APPENDIX.

DISINFECTION BY GASES.

The following constitutes a portion of a paper on Disinfection, which I read at a meeting of the Medical Society of the King and Queen's College of Physicians in 1872:—

As generally performed, disinfection by gases is by no means efficacious. This, I think, I have proved by showing that even considerable quantities of chlorine and sulphurous acid do not kill the bacteria which are usually associated with putrefaction, nor perfectly destroy the contagious matter of at least one zymotic disease.¹

Several watch and microscopic object glasses were dipped into filtered beef-tea, which contained enormous numbers of bacteria, and whilst still moist they were placed in different positions in a hood, or small chamber made of wood and glass, containing 16½ cubic feet of space. Half an ounce of chloride of lime was placed in a capsule and introduced into the hood, and an equivalent quantity of hydrochloric acid was poured on the powder in such a way as to prevent the chlorine evolved from passing out of the hood. After the lapse of twenty-four hours the door of the hood was opened and the glasses removed. They were found to be covered with extremely thin films of solidified beef extract. A few drops of pure water were used to render the film semi-liquid, and its contents were examined with a microscopic power of 800 diameters. In a few seconds the bacteria were detected moving about with great rapidity, and with apparently undiminished vigour. It was clear, then, that fumigation at the rate of a little more than three ounces of bleaching powder per 100 cubic feet of space had no effect in destroying bacteria. The hood was more air-tight than a room is when its doors, windows, and fire-place are closed. On opening the door of the hood after twenty-four hours the odour of chlorine was distinctly perceived at a distance of several feet. If a room 15 feet long, 10 feet wide, and 10 feet high, and having, therefore, a capacity of 1,500 cubic feet, were disinfected by chloride of lime in the relative proportions employed in the foregoing experiment, it would be necessary to use nearly three pounds of chloride of lime.

As the gases evolved from three ounces of bleaching powder per 100 cubic feet of space did not destroy bacteria, an experiment was

¹ On the Application of Gases as a Means of Destroying Contagion. By Charles A. Cameron, M.D. Dublin Journal of Medical Science, June, 1872

made with one ounce per $16\frac{1}{2}$ cubic feet, or at the rate of nearly six pounds per 1,500 cubic feet—the size of a small room. The result was similar to that of the first experiment, the bacteria being almost as lively after as they were before the process.

The next quantity tried was one and a-half ounces of bleaching powder per $16\frac{1}{2}$ cubic feet, or at the rate of about eight and a-half pounds per a room of 1,500 cubic feet capacity. After twenty-four hours exposure to the highly chlorinated atmosphere produced by this experiment, the greater number of bacteria were not only alive, but most of them exhibited the utmost vitality. Two ounces of bleaching powder per $16\frac{1}{2}$ cubic feet were next tried, and after exposure to the gases evolved from this quantity by the action of an acid, the bacteria, though languid, were still mostly alive, and a few of them were very active. The last experiment was made with three ounces of bleaching powder per $16\frac{1}{2}$ cubic feet, or at the rate of $16\frac{1}{2}$ pounds of the disinfectant to 1,500 cubic feet; but even the enormous amount of gas evolved from this quantity failed to kill the greater number of the bacteria subjected to its influence. Films of moist meat extract containing bacteria were next exposed to an atmosphere of equal parts of chlorine gas and ordinary air. This operation was conducted in an air-tight glass vessel. After twenty-four hours they were examined, and no life could be perceived. Dried films of meat extract containing bacteria were submitted to the influence of this gaseous matter; but, after being moistened, many of the bacteria were found still alive, though almost inactive.

Similar experiments were made to ascertain the action of sulphurous acid gas upon bacteria, but this gas was also found to produce but little effect on these animalcules.

Having proved that the bacteria, which exist in liquids, are not destroyed by exposure to atmospheres highly charged with chlorine, or sulphurous acid gas, an experiment was next made with the view of ascertaining whether or not the germinal matter of bacteria could be destroyed by ordinary gaseous disinfection. Accordingly filtered beef tea, which did not exhibit any forms of life under the microscope, was divided into three parts. One portion (*a*) was placed in a test tube, and loosely plugged with cotton wool; another portion (*b*) was placed in a test tube, which had shortly before been heated nearly to redness, and loosely plugged with cotton wool, which had been highly heated to 350° ; the third portion (*c*) was poured upon microscopic objects and shallow watch glasses, and these were placed in the hood and exposed for forty-eight hours to the gases evolved from two ounces of bleaching powder treated with acid. In twenty-four hours the liquid (*d*) which had simply been deposited in a test tube was found to swarm with myerozymes; the liquid which had been placed in the tube that had been heated to redness was, after a week, found to be free from animal life, whilst a few hours after their removal from the hood, the films of beef-tea exhibited swarms of vibriones, although

every precaution was taken to prevent contamination from solid substances subsequent to the removal of the glasses from the hood.

The following experiment was made in a room of 1,600 cubic feet capacity. Animal liquids containing microzymes were placed upon the chimney-piece, upon the window panes, and other smooth parts of the apartment. Seven pounds of chloride of lime were then decomposed by oil of vitriol, and the room carefully closed up. After forty-eight hours the room was opened, and the films containing the bacteria were, with every proper precaution, washed upon object glasses, and examined microscopically. In every case there were large numbers of living microzymes.

The next experiment was conducted as follows :—

Four ivory points, charged with vaccine lymph, were placed in the hood, and subjected, during twenty-four hours, to the influence of the gases evolved from one ounce of bleaching powder decomposed by acid. With these points I successfully re-vaccinated two persons. The other points failed. Six charged points were next exposed to the gases evolved from two ounces of chloride of lime per $16\frac{1}{2}$ cubic feet; but attempts to vaccinate with these points proved unsuccessful.

The results of these experiments show that bacteria and the contagious particles of vaccine lymph resist, when protected by an extremely thin film of solid or semi-solid matter, the action of chlorine and sulphurous acid gases applied to them in larger quantities than are usually employed in disinfection. The filtered meat-juice used in these experiments contained only five grains of solid matter per ounce of 480 grains—less than one per cent. The object glasses were dipped in this liquid, and many of them allowed to drain before being subjected to experiment. We may readily conceive, then, how extremely thin the film was that separated the bacteria from the gases set free in the hood. It is extremely improbable that the actual contagious particles of small-pox or cholera, or similar diseases, are ever detached from the serum and other matter with which they associated when thrown off from the body. They are, no doubt, invested with some such film as that which protects the contagious granules in vaccine. If ordinary gaseous disinfection sometimes fails to destroy the vitality of vaccine, and has no effect on ordinary microzymes, we cannot rely upon it as a means of destroying the contagiums of zymotic diseases, which certainly are near akin, if not to bacteria, at least to the virus of vaccine. The results of the experiments of Grace Calvert show that bacteria sustain a very high temperature without being killed; and, on the other hand, Melsens, in the *Journal de Pharmacie et de Chemie* for September, 1870, proves that vaccine lymph retains its activity when exposed to the intense cold of 80 degs. centigrade. The low forms of life often resist influences which, in the case of the most highly organised animals, produce fatal results.

No doubt, chlorine, sulphurous acid, and some others of the so-

called disinfectants, destroy bacteria and contagia ; but in order to do this, they must be employed in much larger quantities than they have hitherto been used. *Strong* solutions of disinfectants, when mixed with liquids containing microzymes, kill these animalcules, and the germinal matter from which they are evolved ; but gases appear to have comparatively little effect in destroying bacterium life.

The complete disinfection of a room tainted with the poison of contagious disease can only be accomplished by the most thorough cleansing. The paper should be removed from the walls, and the latter scraped. The ceiling should be washed and whitewashed, the woodwork and floors should be scoured ; all these detergent processes remove—probably without utterly destroying them—the contagious particles. The old-fashioned plan of simply whitewashing the walls and ceiling of a room, and washing the woodwork, has much to commend it, and it is infinitely more efficacious than gaseous disinfection without liquid applications. If the white-wash does not at once kill the bacteria, it certainly imprisons them securely. The disinfection of the air of the room is best accomplished by a solution of chloride of lime, carbolic acid, chromic acid, chloralum, &c., applied in the form of spray ; but this process is not likely to be generally adopted. A little chlorine may be generated in the room, and if it do no more than remove a bad odour, it will prove useful. As people cannot comfortably breathe in a room which has just been disinfected by sulphurous acid, or chlorine, they are obliged to open doors and windows in order to admit the fresh air. In this way the use of disinfectants is to be commended, because it obliges people to ventilate their apartments. If solutions of disinfectants be applied to the walls and woodwork, they should be strong ones—say half a pound of chloride of lime to an imperial gallon of water.

During the visitation of cholera in Leipsic in 1866, the chemical professor, Carus, was appointed head disinfector of the town, which was divided into 100 districts, each of which had a separate inspector. Never was disinfection more thoroughly carried out. Every house in which cholera appeared was disinfected with chlorine gas. And what was the result ? There had been thirteen outbreaks of cholera in Leipsic since the first appearance of the disease in Europe, and never was the attack so severe as in the year 1866, when disinfection was carried out in so careful a manner. It was the same in Stettin and Erfurth, where disinfection was carried out under the orders of the Government, and by a staff such as we could not have in this country.

A COLLECTION

OF

SANITARY STATUTES APPLICABLE TO IRELAND,

TOGETHER WITH

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THE PUBLIC HEALTH (IRELAND) ACT, 1874.

37 & 38 VICT., CAP. 93.

An Act to amend the Law relating to Public Health in Ireland.

[7th August, 1874.]

Be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

Preliminary.

1. This act may be cited for all purposes as "The Public Health Short title. (Ireland) Act, 1874."

Sanitary Authorities.

2. From and after the passing of this act Ireland shall be divided into sanitary districts, to be called respectively—

(1.) Urban sanitary districts; and

(2.) Rural sanitary districts;

and such urban and rural sanitary districts shall respectively be subject to the jurisdiction of local authorities, in this act called urban sanitary authorities and rural sanitary authorities, invested with the powers in this act mentioned.

3. Urban sanitary districts shall consist of the places in that behalf mentioned in the first column of the table in this section contained, and urban sanitary authorities shall be the several bodies of persons specified in the second column of the said table in relation to the said places respectively.

Urban and Rural
Sanitary
Districts.

Description
of Urban
Sanitary Dis-
tricts and
Urban Sani-
tary Authorities.

TABLE above referred to.

Urban Sanitary District.	Urban Sanitary Authority.
The City of Dublin	The Right Honourable the Lord Mayor, Aldermen, and Burgesses acting by the Town Council.
Towns corporate, with exception of Dublin	The Mayor, Aldermen, and Burgesses acting by the Town Council.
Towns, the population of which according to the last Parliamentary Census exceeds six thousand, having Commissioners appointed by virtue of an act made in the ninth year of the reign of George the Fourth, intituled "An Act to make provision for the lighting, cleansing, and watching of cities and towns corporate and market towns in Ireland in certain cases."	The Commissioners.
Towns, the population of which according to the last Parliamentary Census exceeds six thousand, having Municipal Commissioners under 3 and 4 Vict., c. 103.	The Municipal Commissioners.
Towns, the population of which according to the last Parliamentary Census exceeds six thousand, having Town Commissioners under the Towns Improvement (Ireland) Act, 1854 (17 and 18 Vict., c. 103).	The Town Commissioners.
Towns or townships having Commissioners under Local Acts.	The Town or Township Commissioners.

Description
of Rural
Sanitary Dis-
tricts and
Rural Sanitary
Authorities.

4. The area of every poor law union, with the exception of those portions (if any) of the area which are included in urban sanitary districts, shall form a rural sanitary district, and the guardians of the union shall, as such, be the rural sanitary authority of such district, subject to the following conditions; that is to say—

- (1.) No elective guardian of any electoral division belonging to such union, and forming or being wholly included within an urban sanitary district, shall act or vote in any case in which guardians of such union act or vote in their capacity of members of the rural sanitary authority.
- (2.) Where part of an electoral division belonging to a union forms or is situated in an urban sanitary district, the Local Government Board may, by order, divide such electoral division into separate wards and determine the number of guardians to be elected by such wards respectively, in such manner as to provide for the due representation of the part of the electoral division lying within the rural sanitary district; but until such order has been made the guardian or guardians of such electoral division may act and vote as members of the rural sanitary authority in the same manner as if no part of such electoral division formed part of or was situated in an urban sanitary district;
- (3.) An ex-officio guardian resident in any electoral division, or part thereof, belonging to such union which forms or is situated in an urban sanitary district shall not act or vote in any case in which guardians of such union act or vote in their capacity of members of the rural sanitary authority, unless he is the owner or occupier of property situated in the rural sanitary district of a value sufficient to qualify him as an elective guardian for the union.

Power to alter
Sanitary
Districts.

5. The Local Government Board shall have power, by provisional order, to separate from a rural sanitary district any town or district wholly situate therein, the population of which according to the then last parliamentary census exceeds six thousand, and to constitute it an urban sanitary district, or to include it in any adjoining urban sanitary district, subject as such to all the provisions of this act affecting urban sanitary districts; and the said board shall likewise have power by provisional order to add any town or township hereby constituted an urban sanitary authority to the rural sanitary district in which it is situate, to be subject thereafter to all provisions of this act affecting rural sanitary districts. No such provisional order shall be made except upon petition from such town, township, or district, in accordance with the provisions of "The Local Government (Ireland) Act, 1871," as amended by "The Local Government Board (Ireland) Act, 1872," with respect to the incorporation with or separation from any town of any district: provided always that the said provisions shall for such purposes be read as if the expression "sanitary authority" were therein substituted for the expression "governing body;" nor shall any such provisional order take effect until confirmed by parliament in manner prescribed by the said provisions.

First Meeting
of Sanitary
Authority.

6. The first meeting of a sanitary authority under this act shall be held within sixty days after the passing of this act, on such day as may be directed by order of the Local Government Board in each case.

Powers and
Duties of
Sanitary
Authority.

7. Subject to the provisions of this act, except as hereinafter is excepted, and from and after the day appointed for the first meeting of a sanitary authority in pursuance of this act, there shall be transferred and attach to such sanitary authority, to the exclusion of any other authority which may have previously exercised or been subject to the same, all powers, right, duties, capacities, liabilities, and obligations within such district exerciseable or attaching by and to the sewer

authority under the Sewage Utilization Acts, and by and to the nuisance authority under the Nuisances Removal Acts, and by and to the local authority under the Common Lodging Houses Acts, the Artisans and Labourers' Dwellings Act, and the Bakehouse Regulation Act, as the said acts are respectively varied or amended by any act, or any local act, or any provisional order in force within such district, or by and to any of the said authorities under any of such acts as aforesaid: provided always that in any urban sanitary district the urban sanitary authority shall, subject to the provisions of this act, continue to act in execution of any act or local act or provisional order in force within such district immediately before the passing of this act, and in the execution of which at such time the body by this act constituted such urban authority was acting; and provided further, that in any rural sanitary district there shall be transferred and attach to the rural sanitary authority, to the exclusion of any other authority which may have previously exercised or been subject to the same, all powers, rights, duties, capacities, liabilities, and obligations with respect to sanitary matters under any act, local act, or provisional order in force within such district, or any part of the same, immediately before the passing of this act; but, save as aforesaid, such act, local act, or provisional order shall continue in full force and effect, and shall be carried into execution by the same authority and in the same manner in every respect as if this act had not been passed. If any question arises as to what are sanitary matters within the meaning of this section, or as to any matter or thing affected by this section, the determination of the Local Government Board on any such question shall be conclusive.

Where the Baths and Wash-houses Acts and the Labouring Classes Lodging Houses Acts, or any of them, are in force within the district of any sanitary authority, such authority shall have all powers, rights, duties, capacities, liabilities, and obligations in relation to such acts exercisable by or attached to the council, town commissioners, or other commissioners or persons acting in the execution of the said acts, or any of them.

Where the Baths and Wash-houses Acts are not in force within the district of any sanitary authority, such sanitary authority may adopt such acts; and where the Labouring Classes Lodging Houses Acts are not in force within the district of any sanitary authority, such sanitary authority may adopt such acts.

8. Under the provisions of the Diseases Prevention Act the execution of all powers relating to the treatment of disease, and the establishment and maintenance of hospitals, the conveyance of the sick, the disinfection of clothes or dwellings, and the interment of the dead, created by the said act or any other act, or arising out of any order of the Local Government Board, shall vest exclusively in the board of guardians of the union in which the district of the sanitary authority is situate, and the expenses so incurred shall be charged on the poor rates as expenses arising under the Poor Law Acts or the Medical Charities Act, as the case may be.

Powers relating to the treatment of Disease vested in Board of Guardians of the Union in which the Sanitary Authority is situate.

9. From and after the day appointed for the first meeting of the sanitary authority of a sanitary district, in pursuance of this act, all such property, real and personal, including all interest, easements, and rights in, to, and out of property, real and personal (including things in action), as belongs to or is vested in, or would but for this act have belonged to or been vested in, any authority, whose powers, rights, duties, capacities, liabilities, and obligations are transferred to the sanitary authority, shall, so far as such property is applicable to and for the purposes of any such powers, rights, duties, liabilities, capacities, or obligations, pass to and vest in the sanitary authority, subject to all debts, liabilities, and obligations exclusively affecting the property so transferred; and where any debts, liabilities, or obliga-

Transfer of Property to Sanitary Authority, and effect of transfer of Property and powers.

tions affect such property together with other property, then subject only to such part of such debts, liabilities, and obligations as shall bear to the whole amount of such debts, liabilities, and obligations the proportion which the property so transferred bears to the whole property affected by such debts, liabilities, and obligations.

All debts, liabilities, and obligations subject to which any such property has been transferred, or which previously to such transfer were incurred by the authority whose powers, rights, duties, liabilities, capacities, and obligations are so transferred in the exercise of such powers and rights, or in the discharge of such duties, or by reason of such liabilities and obligations, may be enforced against the sanitary authority to the same extent and in the same manner as they might have been enforced against the authority from which such transfer has taken place; and such last-mentioned authority shall be deemed to be discharged from such debts, liabilities, and obligations.

All property by this section transferred to a sanitary authority shall be held by it upon trust for the district or several places respectively within its jurisdiction to which such property belonged, or for the benefit of which such property was held previously to its transfer.

Sanitary
Officers and
Superintendent
Officers of
Health.

10. Every medical officer of a dispensary district shall be a sanitary officer for such district, or for such part thereof as he shall personally be in charge of, with such additional salary as the sanitary authority thereof may determine, with the approval of the Local Government Board; and every sanitary authority, whether urban or rural, shall appoint such other sanitary officers, including a medical superintendent officer of health when deemed necessary, as the Local Government Board shall in each case direct, with such salaries or additional salaries as the said sanitary authority shall determine, with the approval of the Local Government Board; and the said board shall assign to the dispensary medical officers, and to the other sanitary officers, if any, and to the medical superintendent officer of health, if such an officer be appointed for the sanitary district, their respective duties and functions in the discovery or inspection or removal of nuisances, in the supply of pure water, in the making or repairing of sewers and drains, or in generally superintending the execution of the sanitary laws within the district.

Every such salary or additional salary so determined or approved shall be payable from such local fund as the Local Government Board shall indicate as properly chargeable therewith, and such part thereof as Parliament shall from time to time determine shall be recouped to such local fund out of moneys to be voted by Parliament; and the Local Government Board shall have the same powers with regard to the qualification, appointment, duties, regulation of salary, and tenure of office of every sanitary officer as they have in the case of the medical officer of a dispensary district: provided, with regard to salaries or additional salaries, whereof any portion is to be recouped to any local fund from moneys voted by Parliament, the amount of any new salary, and the proportion between any existing salary and the addition thereto, shall be regulated according to a scale to be approved by the Commissioners of her Majesty's Treasury.

Powers of
Inspectors
of Local
Government
Board.

11. Inspectors of the Local Government Board may attend any meetings of sanitary authorities, or of committees of sanitary authorities, during the transaction of business arising under any of the provisions of the sanitary acts; and such inspectors shall, for the purposes of any inquiry directed by the said Local Government Board, in relation to witnesses and their examination, the production of papers and accounts, the inspection of places and matters required to be inspected, have for the purposes of the Sanitary Acts or Burial Grounds Acts, or any of the said acts, similar powers to those which inspectors have under the Poor Law Acts and under the Medical Charities Act for the purposes of those acts.

12. All expenses incurred or payable by an urban sanitary authority under the Sanitary Acts shall, notwithstanding anything in the said acts or any of them to the contrary, be defrayed as follows; that is to say,

Expenses of
Urban
Sanitary
Authority.

(1.) In the case of the council of a borough, out of the borough fund or borough rate :

(2.) In the case of an urban sanitary authority being commissioners under any of the acts specified in the first column of the table contained in section three or of any local act, out of any rate leviable by them as such commissioners throughout the whole of their district :

Provided that where an urban sanitary authority had, before the passing of this act, power to levy throughout the whole of its district a rate or rates for paving, sewerage, or other sanitary purposes, all expenses incurred by such authority in the performance of its duties under the Sanitary Acts shall be defrayed out of such rate or rates, except where at the time of the passing of this act any such expenses were chargeable upon the borough fund or borough rate, in which case such expenses shall continue so chargeable : provided also, that if application be made to the Local Government Board, whereby it shall be alleged that it would be inequitable or inconvenient in the district of any urban sanitary authority that the said expenses should be borne as last aforesaid, the said board may, after inquiry, by a provisional order, alter the incidence of such charge in respect of the whole or some of the expenditure referred to, as to them shall appear to be fair and equitable.

13. The expenses incurred by a rural sanitary authority under the Sanitary Acts shall be divided into general expenses and special expenses.

Expenses of
Rural
Sanitary
Authority.

General expenses, other than those chargeable upon owners and occupiers under the Sanitary Acts, shall be the expenses of the establishment and officers of the sanitary authority, and all other expenses not determined by this act or the order of the Local Government Board to be special expenses.

Special expenses shall be the expenses of the construction, maintenance, and cleansing of sewers in any contributory place within the district, the providing a supply of water to any such place, the providing, repairing, and cleansing public wells, the lighting where duly authorized, the charges or expenses arising out of or incidental to the possession of property transferred to the rural sanitary authority in trust for any district or contributory place, and all other expenses incurred or payable by the sanitary authority in or in respect of any contributory place within the district, and determined by the order of the Local Government Board to be special expenses.

When the rural sanitary authority makes any sewers or provides any water supply or executes any other work under the Sanitary Acts for the common benefit of any two or more contributory places within its district, it may apportion the expense of constructing any such work and of maintaining the same, in such proportions as it thinks just, between such contributory places ; and any expense so apportioned to any such contributory place shall be deemed to be special expenses legally incurred in respect of such contributory place.

Ten or more ratepayers, or any number of persons liable to be rated to one-fifth part of the whole rate, of any contributory place, if aggrieved by any such apportionment, may send or deliver a memorial to the Local Government Board, stating their grounds of complaint, and the said board may, after due inquiry, make such order in the matter as to it may seem equitable, and the order so made shall be binding and conclusive upon all parties concerned.

General expenses shall be payable out of a common fund to be raised out of the poor rate of the electoral divisions or parts thereof in the

district, according to the rateable value of each electoral division or part thereof, in manner hereinafter mentioned.

Special expenses shall be a separate charge on some contributory place or places.

The following areas situated in a rural sanitary district shall be contributory places for the purposes of this act; that is to say,

- (1.) The dispensary district :
- (2.) The electoral division :
- (3.) The townland :

Provided that the Local Government Board shall have power to determine on what area of charge being a contributory place, or consisting of contributory places, any special expenses shall be chargeable, whether incurred after the passing of this act or still due in respect of works executed before the passing of this act.

Mode of
raising Con-
tributions in
Rural Sanitary
District.

14. For the purpose of obtaining payment for special expenses from the several contributory places within its district, the board of guardians, being the rural sanitary authority, shall levy the same by a special poundage rate, to be added to the poor rate on such contributory places and to be collected therewith by the collectors of the poor rate and lodged to the credit of the guardians with the treasurer of the union; and the expenditure thereof shall be brought to account in such form and manner as the Local Government Board shall from time to time by any general order direct; and if not otherwise directed by such general order, the sums levied by such special poundage and placed to the credit of the board of guardians shall be applied by them in discharge of the special expenses incurred as aforesaid on account of such contributory places respectively.

Compulsory
powers to
purchase
land for
Hospitals.

15. Every sanitary authority being a port nuisance authority under the provisions of an act passed in the thirty-seventh year of her Majesty, entitled "An Act to amend the Sanitary Act, 1866, so far as the same relates to the nuisance authorities of ports in Ireland," shall, with the consent in writing of the Local Government Board, be empowered to purchase, hire, or erect any building either within or without the district of such sanitary authority for the purpose of an hospital for the reception and treatment of persons affected by dangerous contagious disease, or to purchase land either within or without such district for the purpose of erecting the same, and for these purposes the Lands Clauses Acts are incorporated herewith: Provided always, that for the purposes of such incorporation the terms "special act" and "promoters of the undertaking" in the Lands Clauses Acts shall be construed to mean respectively the consent in writing of the Local Government Board, and any sanitary authority being such a port nuisance authority as aforesaid.

Incorporation
of certain
provisions of
Lands
Clauses Con-
solidation
Act with
Burial Grounds
Act.

16. Whereas by the Burial Grounds (Ireland) Act, 1856, section eighteen, it is provided that the Lands Clauses Consolidation Act, 1845, excepting, among other provisions, the provisions of that act "with respect to the purchase and taking of lands otherwise than by agreement," shall be incorporated with the said act, and it is expedient that those provisions of the Lands Clauses Acts should be incorporated with the said Burial Grounds Act: Be it enacted, that from and after the passing of this act the provisions of the Lands Clauses Acts "with respect to the purchase and taking of lands otherwise than by agreement" shall be incorporated with the said acts, and they are hereby incorporated therewith.

Provided always, that before putting in force any of the powers of the Lands Clauses Acts with respect to the purchase of lands otherwise than by agreement, any burial board shall do all acts, matters, and things, and proceed in manner prescribed by section four of the Local Government (Ireland) Act, 1871, in like manner in every respect as if such burial board were a governing body desiring to put the said provisions of the Lands Clauses Acts in force; and for such

purposes the said section four is incorporated herewith, and for the purposes of such incorporation the terms "governing body" and "Chief Secretary" in the said section shall be construed to mean respectively "burial board" and "Local Government Board."

17. No justice of the peace shall be deemed incapable of acting as such in cases under the Burial Grounds Acts by reason of his being a member of any body thereby declared to be the burial board to execute the said acts, or by reason of his being a contributor or liable to contribute to any rate or fund out of which it is by the said acts provided that all charges and expenses incurred in the execution of the said acts, and not recovered as thereby provided, shall be defrayed.

Justice not
incapable to
act in cases
under Burial
Grounds Acts
by being
Member of
Burial Board
or liable to
Rate.

18. When and so often as representation with reference to a burial ground or burials shall have been made to the Local Government Board under the fifth section of the Burial Grounds (Ireland) Act, 1856, and the Local Government Board (Ireland) Act, 1872, inquiry may be directed by the Local Government Board in the place or district referred to therein, or otherwise, as may be thought fit, as to the genuineness of such representation, and in respect of the several matters relating thereto, after notice shall have been given as provided by said act, and of the time, place, and subject of the inquiry; and it shall be lawful for one of the inspectors of the said board, or other person appointed in that behalf by the board, to hold such inquiry; and for the purposes of such and all other inquiries which the said board shall see fit to direct, the several inspectors, or other persons appointed by the board, shall have all and every the powers and authorities vested in or conferred on poor law inspectors by the nineteenth section of the act of the tenth and eleventh years of the reign of her present Majesty, chapter ninety; and upon receipt of the report of such inspector or other person as to the result of such inquiry, and of the evidence taken thereon, it shall be lawful for the said board to take the same and the matter of such representation into consideration, and to make such order in relation thereto as to them may seem meet.

Inquiries by
Board under
19 and 20
Vic., c. 98.

The twentieth section of the act of the tenth and eleventh years of the reign of her present Majesty, chapter ninety, is hereby incorporated with this section.

Union of Districts.

19. Where it appears to the Local Government Board, on the application of the sanitary authorities of any sanitary districts, or of any of such authorities, and after due inquiry, that it would be for the advantage of such sanitary districts, or any of them, or any parts thereof, or of any contributory places in any rural sanitary district or districts, to be formed into a united district for all or any of the purposes following; that is to say,

Formation
of United
District.

(1.) The procuring a common supply of water; or

(2.) The making a main sewer or carrying into effect a system of sewerage for the use of all such districts or contributory places; or

(3.) For any other purposes of the Sanitary Acts or Burial Grounds Acts, or of any of the said acts,

the said Local Government Board may, by provisional order, form such districts or contributory places into a united district.

20. The following enactments shall take effect in relation to making a provisional order forming a united district; that is to say,

Mode of
forming United
District

(1.) Notice of the provisional order shall be published in some newspaper circulating in the district to which it relates, and in such other manner as the Local Government Board may direct:

(2.) All costs, charges, and expenses of and incidental to the formation of a united district shall, in the event of the united district being formed, be a first charge on the rates leviable in the united district in pursuance of this act :

(3.) The making of a provisional order shall be *prima facie* evidence that all the requirements of this act in respect of proceedings required to be taken previously to the making of such provisional order have been complied with.

Governing
Body of United
District.

21. The governing body of a united district shall be a joint board consisting of such ex-officio members and of such number of elective members as the Local Government Board may, by the provisional order forming the district, determine.

A joint board shall be a body corporate by such name as may be determined by the provisional order, having a perpetual succession and a common seal, with power to acquire and hold lands for the purposes of its constitution without any licence in mortmain.

No act or proceeding of a joint board shall be questioned on account of any vacancy or vacancies therein.

No defect in the qualification or election of any person or persons acting as a member or members of a joint board shall be deemed to vitiate any proceedings of such board in which he or they has or have taken part.

Any minute made of proceedings at a meeting of a joint board, if signed either at the meeting at which such proceedings took place or at the next ensuing meeting by any person purporting for the time being to be the chairman of the board, shall be receivable in evidence of such proceedings in all legal proceedings, without further proof ; and until the contrary is proved every meeting of a joint board where minutes have been so made of the proceedings shall be deemed to have been duly convened and held, and all the members thereof to have been duly qualified.

No member of a joint board by being party to or executing in his capacity of member any contract or other instrument on behalf of the board, or otherwise exercising any of the powers given to the board, shall be subject individually to any action, suit, trial, prosecution, or other legal proceeding ; and a joint board may apply any moneys from time to time coming into its hands for the purpose of paying any costs of legal proceedings or damages it may incur in the exercise of the powers granted to it : provided that nothing in this section shall exempt any member of a joint board from liability to be surcharged with the amount of any payment which may be disallowed by the auditor in the accounts of such joint board, and which such member authorized or joined in authorizing.

Regulation
as to consti-
tution of
joint Board.

22. The provisional order forming a united district under this act shall define the purposes for which such united district is formed, and the powers, rights, duties, capacities, liabilities, and obligations under the Sanitary Acts which the joint board is authorized to exercise or perform or is made subject to, and shall contain regulations as to the qualification and mode of election of elective members of the joint board, as to their continuance in office, as to casual vacancies in the joint board, as to its meetings and officers, and any other matter or thing, including the adjustment of present and future liabilities and property with respect to which the Local Government Board may think fit to make any regulations for the better carrying into effect the provisions of this act with respect to united districts.

Upon the constitution of a joint board the sanitary authorities having jurisdiction in the component districts or contributory places shall cease to exercise therein any powers, or to perform any duties, or to be subject to any liabilities or obligations which the joint board is authorized to exercise or perform or is made subject to ; nevertheless the said joint board may delegate to the sanitary authority of any

component district the exercise of any of its powers for the performance of any of its duties, with the approval of the Local Government Board.

23. Any expenses incurred by a joint board in pursuance of this act, unless otherwise determined by the provisional order, shall be defrayed out of a common fund to be contributed by the component districts or contributory places, in proportion to the rateable value of the property in each district or contributory place, such value to be ascertained according to the valuation list in force for the time being.

Expenses incurred by joint Board, how to be defrayed.

A joint board may borrow and take up at interest on the credit of such common fund any sums of money necessary for defraying any such expenses, subject to the regulations of the Local Government (Ireland) Act, 1871, with respect to borrowing under that act, as the same are amended by this act.

24. For the purpose of obtaining payment from component districts of the sums to be contributed by them, the joint board shall issue its precept to the sanitary authority of each component district stating the sum to be contributed by it and requiring such authority, within a time limited by the precept, to pay the sums therein mentioned to the joint board or to such person as the joint board may direct.

Payment of contributions to joint Board.

Any sum mentioned in a precept addressed by a joint board to a sanitary authority as aforesaid shall be a debt due from it, and may be recovered accordingly; such contribution, in the case of a rural sanitary authority, being deemed to be general expenses.

For the purpose of obtaining payment from contributory places of the sums to be contributed by them, the joint board shall have the same powers of issuing precepts and of recovering the amounts named therein as if such contributory places formed a rural sanitary district, and the joint board were the sanitary authority thereof.

25. A sanitary authority unto whose district the district of another sanitary authority is subjacent may, by agreement with the last-mentioned authority, and with the sanction of the Local Government Board given on the application of the first-named authority, after public inquiry, if the said Local Government Board think such inquiry necessary, cause the sewers of its district to communicate for the purpose of outfall with the sewers of the subjacent district, and for the purpose of reception, disinfection, distribution, and disposal of the sewage of such first-named authority by the authority of the subjacent district, or for all, any, or either of those purposes, upon such terms as to payment or otherwise, in such manner as to making and maintaining the outfall, and with and subject to such conditions, precautions, and restrictions as shall be agreed upon between the sanitary authorities, or in case of dispute shall be settled by the Local Government Board: provided that so far as practicable storm waters shall be prevented from flowing from the sewers of the higher into the sewers of the subjacent district, and that the sewage of other districts or places shall not be permitted by the sanitary authority of the higher district to pass into their sewers so as to be discharged through such outfall into the sewers of the subjacent district without the consent of such last-mentioned district; and all expenses incurred in pursuance of this section by the said sanitary authorities, or either of them, shall be deemed to be expenses incurred by them respectively in performance of their duties under the Sanitary Acts, and be respectively payable accordingly out of the rates out of which such expenses are by this act made payable, or out of moneys duly borrowed on the credit of such rates.

Use of sewer of subjacent district for outfall of district above it.

Repeal of Acts.

26. The Local Government Board may, on the application of the sanitary authority of any district, by provisional order, Repeal of Local Acts.

wholly or partially repeal, alter, or amend any local acts, other than acts for the conservancy of rivers, in force in such district, and not conferring powers or privileges upon corporations, companies, undertakers, or individuals for their own pecuniary benefit, which relate to the same subject matters as the Sanitary Acts, and may in like manner extend the provisions of any such local act beyond the boundaries of the district comprised therein, or diminish the area to which any such local act shall apply.

Provisions as to the Acquisition of Property, &c.

Extension
of Lands
Clauses Acts
to Easements
and Rights.

27. Subject to the provisions of this act, the powers of the Lands Clauses Acts may, where the same may be put in force with respect to the taking of land under the Sanitary Acts, be applied to all easements and rights in, over, under, or upon land, whether situated within or without the district of the sanitary authority.

Power to
purchase
Water Mills,
Dams, and
Weirs.

28. Subject to the provisions of this act, and of the Sanitary Acts, any sanitary authority may buy up any water mill, dam, or weir which interferes with the proper drainage of or the supply of water to its district; and may for the purpose of supplying its district with water for drinking and domestic purposes purchase either within or without its district any land covered with water, or any water or right to take or convey water; and for the purpose of buying up any of the properties aforesaid, the Lands Clauses Acts shall be incorporated with this section: provided always that before putting in force any of the powers of the Lands Clauses Acts with respect to the purchase of lands otherwise than by agreement for the purposes aforesaid, a sanitary authority shall do all acts, matters, and things, and proceed in manner prescribed by section four of the Local Government (Ireland) Act, 1871, in like manner in every respect as would be necessary in the case of a governing body desiring to put the said provisions of the Lands Clauses Acts in force; and for such purposes the said section four is incorporated herewith, and for the purposes of such incorporation the terms "governing body" and "Chief Secretary" in the said section shall be construed to mean respectively "sanitary authority" and "Local Government Board."

Act not to
affect Navi-
gation of
Rivers or
Canals.
Saving as
to rights.

29. Nothing in this act contained shall enable any sanitary authority to injuriously affect the navigation of any river or canal, or to divert or diminish any supply of water of right belonging to any such river or canal, or to injuriously affect the supply, quality, or fall of water contained in any reservoir or stream, or any feeders of such reservoir or stream belonging to or supplying any waterwork established by Act of Parliament, or in cases where any company or individual are entitled for their own benefit to the use of such reservoir or stream, or to the supply of water contained in such feeders, without the consent in writing of the company or corporation in whom such waterworks may be vested, or of the parties so entitled to the use of such reservoirs, streams, and feeders, and also of the owners thereof in cases where the owners and parties so entitled are not the same person.

Notices to
Owners and
Occupiers
may be
given in
other months
than No-
vember and
December.

30. The notices which, by the fourth section of the Local Government (Ireland) Act, 1871, are required to be given in the months of November and December may be given in the months of September and October, or of October and November, but no inquiry preliminary to the provisional order to which such notices refer shall be held in either of such two last mentioned cases until the expiration of one month from the end of the second of the two months in which the notices are given.

Urban Sani-
tary Autho-

31. Any urban sanitary authority not heretofore empowered to do so may let temporarily, or for a term of years, with the consent of the Local

Government Board, any land or premises which they may possess, as and when they can conveniently spare the same.

rity may let
Land or
Premises.

Miscellaneous.

32. If any officer of any body by this act constituted the sanitary authority of any district is, by or in pursuance of this act or of any provisional order made under the authority of this act, removed from his office or deprived of the whole or part of the emoluments of his office, and is not employed in an office of equal value, and with equal privileges, by such sanitary authority, the Local Government Board may by order award to such officer such compensation as the said board may think just; and such compensation may be by way of annuity or otherwise, and shall be paid by the authority of the sanitary district in which such officer held his office out of the rates applicable to sanitary purposes within that district.

Compensa-
tion to
Officers in
certain cases.

33. Where in any local acts the consent, sanction, or confirmation of the Lord Lieutenant, the Chief Secretary of the Lord Lieutenant, or the Privy Council is required with respect to the borrowing of any money, to the giving effect to any bye-laws, or to the appointment of any officer for sanitary purposes, the consent, sanction, or confirmation of the Local Government Board shall, after the passing of this act, be required instead of that of the authorities above named.

As to consent
of Local
Government
Board re-
quired in
certain cases.

The consent of the Local Government Board, and not that of the Treasury, shall be required to the borrowing of money for the purposes of the Baths and Wash-houses Acts.

The powers vested in or exercisable by one of her Majesty's principal Secretaries of State under the Markets and Fairs Clauses Act, 1847, so far as the same relate to Ireland, are hereby transferred to the Local Government Board, and may in Ireland be exercised by the Local Government Board.

The approval of the Local Government Board, and not that of the Lord Lieutenant, shall be required for the appointment and removal of analysts under the act of the session of the twenty-third and twenty-fourth years of the reign of her Majesty, chapter eighty-four, as amended by the act of the session of the thirty-fifth and thirty-six years of the reign of her Majesty, chapter seventy-four.

If any question arises as to what are sanitary purposes within the meaning of this section, the determination of the Local Government Board on such question shall be conclusive.

34. It shall be lawful for the Lord Lieutenant, by order in council, at any time before the first day of January, one thousand eight hundred and seventy-five, to direct that the powers and duties of the Board of Trade under the "Alkali Act, 1863," and any act amending the same, shall be transferred to the Local Government Board; and from and after the date of such order, or if no such order shall be made, then from and after the said first day of January, one thousand eight hundred and seventy-five, the powers and duties of the Board of Trade under the said acts shall be transferred to and be exercisable and performed in Ireland by the Local Government Board; and "the Local Government Board for Ireland" shall be deemed to be substituted for the "Board of Trade" wherever the latter expression occurs in the said acts.

Transfer of
powers and
duties of
Board of
Trade under
Alkali Act,
1863, to
Local Govern-
ment Board.

35. Upon the application of any authority from whom or to whom any powers, rights, duties, capacities, liabilities, obligations, and property, or any of them, are transferred or alleged or claimed to be transferred in pursuance of this act, upon the passing of this act, or at any time thereafter by the operation of this act or of any provisional order made under the authority of this act, or of any person affected by such transfer, the Local Government Board may by order settle any doubt or difference and adjust any accounts arising out of or incidental to such powers, rights, duties, capacities, liabilities, obligations,

Settlement
of differences
arising out
of transfer
of powers or
property to
Sanitary
Authority.

or property, or to the transfer thereof, and direct the parties by whom and to whom any moneys found to be due are to be paid, and the mode of raising such moneys; and any provisions contained in any order so made shall be deemed to have been made in pursuance of and to be within the powers conferred by this section, subject to this proviso, that where any such order directs any rate to be made or other act or thing to be done which the party required to make or do would not, apart from the provisions of this act, have been enabled to make or do by law, such order shall be provisional only until it has been confirmed by parliament.

Expenses of
Police Officer
acting under
29 & 30 Vict.
c. 90, s. 16,
provided for.

36. Where, under the directions of the Local Government Board, the chief officer of police in any place institutes proceedings under the sixteenth section of the Sanitary Act, 1866, he shall be entitled to recover from the sanitary authority in default all such expenses in and about such proceedings as he may incur, and as shall not be paid by the party proceeded against: provided always, that in the construction of the said act as amended hereby, the term chief officer of police shall mean in any place within the police district of Dublin metropolis either of the commissioners of police for the said district, and in any place elsewhere the sub-inspector of the Royal Irish Constabulary in whose district such place is situate.

Order
against a
defaulting
Sanitary
Authority
may be en-
forced by
mandamus.

37. When the Local Government Board shall have at any time made any order under the forty-ninth section of the Sanitary Act, 1866, limiting the time for the performance by any sanitary authority of its duty, such order may be enforced by writ of mandamus, notwithstanding the provision in the said section contained for the performance of the duty in the event of the continued default of the sanitary authority.

Payments
to Members
of Sanitary
Authority
as Counsel
illegal.

38. Any payment to any member of a sanitary authority or burial board for acting as counsel, solicitor, attorney, or agent for such authority or board shall be illegal; and if any member of any such authority or board shall so act, or shall accept or hold any office or place of profit under such authority or board of which he is a member, or shall in any manner directly or indirectly be concerned in any bargain or contract entered into by or on behalf of such authority or board, or participate in the profits thereof, then and in every such case such person shall cease to be a member of such authority or board, and his office as such shall thereupon become vacant.

Duty of
Urban
Authority
to cleanse
Streets,
Privies, and
Ashpits.
Penalty on
neglect of
Sanitary
Authority
to cleanse
Privies or
Ashpits.

39. Every urban sanitary authority shall, when the Local Government Board by order so direct, make due provision for the proper cleansing of streets which such authority is obliged to maintain and repair, the removal of house refuse from premises, and the cleansing of earth closets, privies, ashpits, and cesspools within its district.

If any sanitary authority having made such provision fail, without reasonable excuse, after notice in writing from the occupier of any house situated in such district requiring such authority to remove any house refuse, or to cleanse any earth-closet, privy, cesspool, or ash-pit belonging to such house, or used by the inmates or occupiers thereof, to cause the same to be removed or cleansed, as the case may be, within seven days, the sanitary authority shall on summary conviction be liable to pay to the occupier of such house a penalty not exceeding five shillings for every day during which such default continues after the expiration of the said period of seven days.

Power of
raising money
on credit of
Rates.

40. Any sanitary authority may, for the purpose of defraying any costs, charges, and expenses incurred or to be incurred by it in the performance of its duties under the Sanitary Acts, borrow and take up at interest any sums of money necessary for defraying any such costs, charges, and expenses, subject to the regulations in the Sanitary Acts.

An urban sanitary authority may borrow and take up at interest such money on the credit of all or any rates or rate out of which it is

authorised by the Sanitary Acts to pay any expenses incurred by it for sanitary purposes, and may mortgage any such rate or rates to the persons by or on behalf of whom such money is advanced for securing the repayment to them of the sums borrowed, with interest thereon.

A rural sanitary authority may borrow and take up at interest such money, if intended to be applied to purposes constituting the general expenses of such authority, on the credit of the common fund out of which such expenses are payable, and if intended to be applied to purposes constituting the special expenses of such authority, on the credit of any rate or rates out of which such expenses are payable, and may mortgage any such rate or rates to the persons by or on behalf of whom such money is advanced for securing the repayment to them of the sums borrowed, with interest thereon.

The clauses of the Commissioners Clauses Act, 1847, with respect to the mortgages to be executed by the commissioners shall, so far as the same are not inconsistent with the provisions of this act, be incorporated with this act; and in the construction of that act "the special act" shall mean this act; "the commissioners" shall mean any authority authorised to borrow by this act; "the clerk of the commissioners" shall include any officer appointed for the purpose by any such authority.

The mortgagees or assignees of any mortgage made in pursuance of this act may enforce payment of the arrears of principal and interest due to them by the appointment of a receiver.

41. Where any sanitary authority or joint board is possessed of any land, works, or other property in pursuance and for the purposes of the Sewage Utilization Act, 1867, such authority or joint board may borrow any moneys on the credit of such lands, works, or other property, and may mortgage such lands, works, or other property to any person advancing such moneys, in the same manner in all respects as if such sanitary authority or joint board were the absolute owner, both at law and in equity, of the lands, works, or other property so mortgaged. The moneys so borrowed shall be applied for purposes for which moneys may be borrowed under the Sanitary Acts; but it shall not be in any way incumbent on the mortgagees to see to the application of such moneys, nor shall they be responsible for any misapplication thereof.

Power of raising money on credit of Sewage Land and Plant.

The powers of borrowing conferred by this section shall, where the sums borrowed do not exceed three-fourths of the purchase money of such lands (but not otherwise), be deemed to be distinct from and in addition to the general borrowing powers conferred on a sanitary authority or joint board by the Sanitary Acts. The sanitary authority or joint board may pay out of any rates leviable by it for sanitary purposes the interest on any moneys borrowed by such authority or joint board in pursuance of this section.

42. Any limit imposed on or in respect of any rate by any local Act of Parliament shall not apply to any rate required to be levied for the purpose of defraying any expenses incurred by a sanitary authority for sanitary purposes.

Limit of Rating under Local Acts not to apply to expenses for sanitary purposes. Commissioners of Public Works in Ireland may lend to Sanitary Authority on security of rates.

43. The Commissioners of Public Works in Ireland may, with the consent of the Commissioners of her Majesty's Treasury, on the recommendation of the Local Government Board, make any loan to any sanitary authority, for such objects as the Commissioners of her Majesty's Treasury may deem to be sanitary improvements, in pursuance of any powers of borrowing conferred by the Sanitary Acts, whether for works already executed, or yet to be executed; such loan to be repaid within a period not exceeding thirty or fifty years as provided by those acts, and to bear interest at the rate of three and a half

per centum per annum, or such other rates as may, in the judgment of the said commissioners, be necessary in order to enable the loan to be made without loss to the Exchequer, on the security of any fund or rate applicable to sanitary purposes, and without requiring any further or other security.

Provided as follows :—

(1.) That in determining the time when a loan under this section shall be repayable, the Commissioners of Public Works in Ireland shall have regard to the probable duration and continuing utility of the works in respect of which the same is required :

(2.) That in the case of any loan already made to any sanitary authority in pursuance of any powers conferred by the Sanitary Acts, the Commissioners of Public Works in Ireland may reduce the interest payable thereon to the rate of not less than three and a half per centum per annum :

(3.) That this section shall not extend to any loan under "The Sanitary Loans Act, 1869," required for the purpose of defraying the expenses incurred or to be incurred by the Local Government Board in the performance of the duty of a defaulting local authority after the passing of this act.

Amendment
of s. 60 of
17 & 18
Vict., c. 103.

44. Where in any town in which the Towns Improvement (Ireland) Act, 1854, is in force the provisions of that act with respect to water have been adopted, the amount of any assessment under section sixty of the said act may, notwithstanding the limitations in the said section contained, amount to but shall not exceed the rate of two shillings in the pound.

Amendment
of 34 & 35
Vict., c. 109,
regarding
loans.

45. The twenty-eighth section of the Local Government (Ireland) Act, 1871, shall extend to re-borrowing for the purpose of discharging previous loans, as well as to original loans, and be amended so that the following provision shall be substituted for that contained in the paragraph No. 3 ; namely :

The money so borrowed shall not at any time exceed, with the balances of all the outstanding loans of the sanitary authority under the Sanitary Acts, in the whole twice the net annual value of the premises assessable within the district in respect of which such money may be borrowed, and the time for which the money may be borrowed shall not exceed sixty years, instead of thirty years, as in the said section is declared :

Provided that where the proposed loan with such balances would exceed the net annual value of such premises, the Local Government Board shall not give their sanction to the loan until a local inquiry shall have been held by one of their inspectors, and his report of the result of such inquiry shall have been received by them :

Provided also that where a loan is effected to pay off an existing loan, the time for repayment shall not extend beyond the unexpired term of the period for which the original loan was contracted, unless with the sanction of the Local Government Board, and shall in no case be extended beyond the period of sixty years from the date of the original borrowing.

The sixth section of the Local Government (Ireland) Act, 1871, and the eighth section of the Local Government Board (Ireland) Act, 1872, are hereby repealed, except so far as the same may apply to any proceedings commenced, but not completed at the passing of this act.

Confirmation
of provisional
orders by
Parliament.

46. The Local Government Board shall not make any provisional order under this act unless public notice shall have been previously given by advertisement in two successive weeks in some newspaper published or circulating in the district to which such provisional order relates, and after hearing any objections which may be made thereto by any persons affected thereby, and in cases where the subject matter

is one to which a local inquiry is applicable, until it has made, by one of its inspectors, a local inquiry of which public notice has been given and at which all persons interested have been permitted to attend and make objections.

The Local Government Board may submit to Parliament for confirmation any provisional order made by it in pursuance of this act, but any such provisional order shall be of no force whatever unless and until it is confirmed by Parliament. If while the bill confirming such order is pending in either House of Parliament a petition is presented against any provisional order comprised therein, the bill, so far as it relates to such order, may be referred to a select committee, and the petitioners shall be allowed to appear and oppose as in the case of a bill for a special act.

Any act confirming any provisional order issued in pursuance of the Sanitary Acts, or any of them, may be repealed, altered, or amended by any provisional order made by the Local Government Board and duly confirmed by Parliament. The Local Government Board may revoke, either wholly or partially, any provisional order made by them before the same is confirmed by Parliament; but such revocation shall not be made whilst the bill confirming the order is pending in either House of Parliament.

47. The reasonable costs of any sanitary authority in respect of provisional orders made in pursuance of the Sanitary Acts, or any of such acts, and of the inquiry preliminary thereto, as sanctioned by the Local Government Board, whether in promoting or opposing the same, shall be deemed to be expenses properly incurred for sanitary purposes by the sanitary authority interested in or affected by such provisional orders, and such costs shall be paid accordingly; and if thought expedient by the Local Government Board, the sanitary authority may contract a loan for the purpose of defraying such costs.

Costs of provisional orders.

48. Every order of the Local Government Board under the Sanitary Acts (unless otherwise prescribed by the said acts) shall be published in such manner as that board may direct; and every general order of the Local Government Board made in pursuance of the Poor Law Acts shall be published in the Dublin Gazette, and when so published shall take effect in like manner and shall be of as much force and validity as any general order made and sent in the manner prescribed by the last-mentioned acts, and no further proceeding shall be necessary in such behalf; and as regards any single order of the said board made in pursuance of the said last-mentioned acts, it shall not be necessary henceforth to send a copy thereof to the clerk to the justices of the petty sessions.

Orders of the Local Government Board, how to be published.

49. The accounts of every sanitary authority shall be made up in such form and to such day or days in every year as may be appointed by the Local Government Board in each case. The accounts of a sanitary authority shall be audited by such auditor of the accounts relating to the relief of the poor as the Local Government Board shall appoint for the purpose. An auditor shall with respect to the accounts of sanitary authorities under this section have the like powers, and be subject to the like obligations in every respect, as in case of the audit under the Local Government (Ireland) Act, 1871, as amended by the Local Government Board (Ireland) Act, 1872, and any person aggrieved by the decision of the auditor shall have the like rights and remedies as in the case of such last-mentioned audit.

Audit of Accounts.

Fourteen days' notice of any audit under the said acts or this act shall be sufficient, anything in any act to the contrary notwithstanding.

50. Every sanitary authority shall have power to direct the destruction of any bedding, clothing, or other articles which have been

Sanitary Authority may

order de-
struction of
infectious
bedding, &c.

Regulations
as to lodgings
in every
Sanitary
District.

Notices of
common
Lodging
Houses and
Slaughter
House to be
affixed on
Premises.

Provision
for polluted
water in
wells and
pumps.

exposed to infection from any dangerous infectious disorder, and to give compensation for the same.

51. The Local Government Board may, at its discretion, by notice to be published in the Dublin Gazette, declare the enactment contained in section thirty-five of the Sanitary Act, 1866, to be in force in the district of any sanitary authority, notwithstanding the restrictions in the said section contained; and from and after the publication of such notice the sanitary authority named therein shall be empowered to make regulations in respect of the matters in that section mentioned, but such regulations shall not be of any validity unless and until they are confirmed by the Local Government Board.

Regulations made under the said section may extend to ventilation of rooms, paving and drainage of premises, and to notices to be given and precautions to be taken in case of any infectious or contagious disease.

52. The keeper of every common lodging house which is registered under the Common Lodging Houses' Acts, and the owner or occupier of every slaughter-house causing the same to be licensed or registered, as the case may be, under the Sanitary Acts, shall, when required to do so by the sanitary authority registering or licensing the same, cause a notice with the words "Registered Lodging House," or "Licensed or Registered Slaughter-house," as the case may be, to be affixed on some conspicuous place on the outside of the premises, where the same can be seen by any inspector or officer of the sanitary authority.

Such notice shall be affixed within one month after the registration or licence, as the case may, and shall be continued undefaced and legible so long as the premises are used for the purpose.

Every person who shall make default in this respect, or shall neglect or refuse to affix or renew such notice after requisition in writing from the sanitary authority, shall be liable to a penalty not exceeding £5 for every offence, and of 10s. for every day that the neglect shall continue after conviction.

53. If it shall be represented to any sanitary authority that within their district the water in any well, public or private, or supplied from any public pump, is so polluted as to be injurious to health, such authority may apply to any justices having jurisdiction within their district, in petty sessions assembled, for an order to remedy the same, and thereupon such justices shall summon the person occupying the premises to which the well belongs, if it be private, and as regards any public well or pump, such person (if any) as shall be alleged in the application to be interested in the same, and shall either dismiss the application or make such an order in the case, by directing the well or pump to be permanently or temporarily closed, or the water to be used for certain purposes only, or providing otherwise, as shall appear to them to be requisite to prevent injury to the health of persons drinking the water.

For the purposes of such inquiry the said justices may cause the water to be analyzed at the cost of the sanitary authority applying.

And all the expenses incurred by such authority in and about the procuring of this order, and in carrying it into execution, shall be charged upon the funds applicable to their general expenditure; but in the case of a rural sanitary authority, shall be deemed to be special expenses within the meaning of the Sanitary Acts.

Provided that where the order is made in respect of any private well, any person aggrieved thereby may appeal against the same in the manner provided by the ninety-third section of the Towns Improvement (Ireland) Act, 1854, and with the same incidents and consequences.

Where the justices dismiss the application they may, if they think fit, award such costs to the person summoned as to them shall appear to be reasonable.

54. For the purposes of the twenty-sixth section of the Sanitary Act, 1866, every hospital or place for the reception of the sick which shall be declared by an order of the Local Government Board to be situated within a convenient distance of the district of any sanitary authority, for the purposes of that section shall be deemed to be within the district of such sanitary authority.

Hospital, when
to be deemed
within district.

Where a justice shall make an order under that section for the removal of a sick person to an hospital or other place, he shall address it to such police or other officer as he shall consider expedient; and every person wilfully disobeying the order, or obstructing the execution of the same, shall be guilty of an offence punishable on summary conviction before two justices, and be liable to a penalty not exceeding £10.

55. The right of complaint given by the thirteenth section of the twenty-third and twenty-fourth years of the reign of her Majesty, chapter seventy-seven, shall extend to nuisances in any place, whether on private or public premises, and may be exercised by any inhabitant in such place, or any owner of premises situated therein, or any other person aggrieved or injuriously affected thereby.

Extension of
right of com-
plaint under
Nuisances
Removal
Acts (1860).

56. The second section of the Nuisances Removal Act for England (Amendment) Act, 1863, shall extend to milk in the same manner as if the word "milk" had been introduced after the word "flour" whenever the word "flour" occurs in the said section; and the justice who, under the said section, is empowered to convict the offender therein described may be other than the justice who may have ordered the article to be disposed of or destroyed.

The provi-
sions of the
Nuisances
Removal Act
for England
(Amendment)
Act, 1863,
to extend to
milk.

57. On complaint made by a medical officer of health or by any inspector or other officer of a sanitary authority upon oath, any justice may grant a warrant to any such officer to enter any building or part of a building or other place in which the complainant has reasonable ground for believing that any animal, carcass, meat, poultry, game, fish, fruit, vegetables, corn, bread, flour, or milk, intended for sale for the food of man, which is so diseased, unsound, or unwholesome as to be unfit for the food of man, is kept or concealed, and to search for, seize, and carry away any such animal, carcass, meat, poultry, game, fish, fruit, vegetables, corn, bread, flour, or milk, in order to have the same dealt with in manner provided by law; and any person obstructing any such officer in performance of any duty under this section shall, in addition to any other punishment to which he may be subject, be liable to a penalty not exceeding £20.

Warrant may
be granted by
a justice to
search for
unsound food.

58. If any registrar, or any officer appointed by the guardians to enforce the provisions of the acts relating to vaccination in Ireland, shall give information in writing to a justice of the peace that he has reason to believe that any child under the age of fourteen years, being within the union or district for which the informant acts, has not been successfully vaccinated, and that he has given notice to the father or mother of the said child, or to the person having the care, nurture, or custody of such child, to procure its being vaccinated, and that this notice has been disregarded, the justice may summon such father or mother or person to appear with the child before him at a certain time and place, and upon the appearance, if the justice shall find after such examination as he shall deem necessary that the child has not been vaccinated, nor has already had the small-pox, he may, if he see fit, make an order under his hand and seal directing such child to be vaccinated within a certain time; and if, at the expiration of such time, the child shall not have been so vaccinated, or shall not be shown to be then unfit to be vaccinated, or to be insusceptible of vaccination, the person upon whom such order shall have been made shall be proceeded against summarily, and, unless he can show some reasonable ground for his omission to carry the order into effect, shall be liable to a penalty not exceeding 20s.

Justices may
make an
order for the
Vaccination
of any child
under fourteen
years.

Provided, that if the justice shall be of opinion that the person is improperly brought before him, and shall refuse to make any order for the vaccination of the child, he may order the informant to pay to such person such sum of money as he shall consider to be a fair compensation for his expenses and loss of time in attending before the justice.

Penalty on false representations with respect to infectious disease.

59. If any owner or occupier or person employed to let for hire, or to show for the purposes of letting for hire, any house or part of a house, when questioned by any person negotiating for the hire of such house or part of a house as to the fact of there being in such house, or having within three months previously been therein, any person suffering from an infectious, contagious, or epidemic disease, knowingly makes a false answer to such question, the person so answering falsely shall be guilty of an offence punishable on summary conviction, and, at the discretion of the justices having cognizance of the case, be liable to be imprisoned, with or without hard labour, for a period not exceeding one month, or to pay a penalty not exceeding £20.

Penalty on breach of rules made under sect. 52 of 29 & 30 Vic., c. 90.

60. Any person wilfully neglecting or refusing to obey or carry out or obstructing the execution of any rule, order, or regulation made by the Local Government Board under section fifty-two of the Sanitary Act, 1866, shall be guilty of an offence punishable on summary conviction, and be liable to a penalty not exceeding fifty pounds.

Legal Proceedings.

Legal position of Sanitary Authority.

61. Subject to the provisions of this act, every Sanitary Authority shall, as respects the service of notices in pursuance of the Sanitary Acts by or on behalf of or on such authority, and as respects all legal proceedings, matters, and things to be taken or done in pursuance of the Sanitary Acts by or on behalf of or to such authority, stand in the same position in all respects in which previously to the passing of this act any authority stood whose powers, rights, duties, capacities, liabilities, and obligations are transferred to such authority; and for the purposes of this section a joint board shall be deemed to be a Sanitary Authority.

Notices, how to be signed.

62. Every notice required to be given on behalf of a sanitary authority shall be deemed to be sufficient on their behalf if it be written or printed, and purports to be signed by the clerk or acting clerk of such authority.

Powers given by this Act to be cumulative.

63. All powers given by this act shall be deemed to be in addition to and not in derogation of any other powers conferred by act, local act, provisional order, law, or custom, and such other powers may be exercised in the same manner as if this act had not passed.

Recovery of penalties.

64. Any penalty recoverable under the provisions of this act shall be recoverable in a summary way, with respect to the police district of Dublin metropolis, subject and according to the provisions of any act regulating the powers and duties of justices of the peace for such district, or the police of such district; and with respect to other parts of Ireland, before a justice or justices of the peace sitting in petty sessions, subject and according to the provisions of "The Petty Sessions (Ireland) Act, 1851," and any act amending the same; and all such penalties, when recovered by or on behalf or at the instance of any sanitary authority, or any officer of such authority, shall be paid to such sanitary authority, and by the same applied in aid of their expenses under the Sanitary Acts; and, save as aforesaid, all such penalties shall be applied in manner directed by "The Fines Act (Ireland), 1851," and any act amending the same.

Appointments under 35 & 36 Vict., c. 69, exempt from stamp duty.

65. Whereas by an act passed in the second year of her Majesty, entitled "An Act for the more effectual Relief of the destitute Poor in Ireland," it was enacted that no instrument made in pursuance of that act, nor the appointment of any paid officer engaged in the administra-

tion of the laws for the relief of the poor or in the management or collection of the poor rate, shall be charged or chargeable with any stamp duty whatever, and it is expedient to extend such exemptions from stamp duty to instruments and to appointments made in pursuance of the provisions of the Local Government Board (Ireland) Act, 1872: be it enacted, that no instrument made in pursuance of the provisions of the said last-mentioned act, and no appointment which has been or shall hereafter be made of any paid officer engaged in the administration of the provisions thereof, shall be charged or chargeable with any stamp duty whatever.

Definitions.

66. In this act, if not inconsistent with the context, the following terms have the meanings hereinafter respectively assigned to them; that is to say, Definition.

“Borough” means any place for the time being subject to the act of the session of the third and fourth years of the reign of King William the Fourth, chapter one hundred and eight, intituled “An Act for the regulation of Municipal Corporations in Ireland,” and any act amending the same :

“Local Government Board” means the Local Government Board for Ireland :

“Person” includes any body of persons, whether corporate or incorporate :

“Labouring Classes Lodging Houses Acts” means 29 and 30 Vict., c. 44 (Labouring Classes Lodging Houses and Dwellings Act (Ireland), 1866); 30 and 31 Vict., c. 28 (Labouring Classes Dwelling Houses Act, 1867) :

“Artisans and Labourers Dwellings Act” means 31 and 32 Vict., c. 130 (Artisans and Labourers Dwellings Act, 1868) :

“Bakchouse Regulation Act” means 26 and 27 Vict., c. 40 (Bakehouse Regulation Act, 1863) :

“Diseases Prevention Act” means 18 and 19 Vict., c. 116 (Diseases Prevention Act, 1855), as amended by 23 and 24 Vict., c. 77 (An Act to amend the Acts for the removal of Nuisances and the prevention of Diseases), as the same are amended and extended to Ireland by 29 and 30 Vict., c. 90 :

“Baths and Wash-houses Acts” means 9 and 10 Vict., c. 87 (An Act for promoting the voluntary Establishment in Boroughs and certain Towns in Ireland of Public Baths and Wash-houses) :

“Burial Grounds Acts” means the Burial Grounds (Ireland) Act, 1856, as the same is amended by the 23 and 24 Vict., c. 76.

“Common Lodging Houses Acts” means 14 and 15 Vict., c. 28 (Common Lodging Houses Act, 1851); 16 and 17 Vict., c. 41 (Common Lodging Houses Act, 1853), as amended by 23 Vict., c. 26 :

“Sewage Utilization Acts” means 28 and 29 Vict., c. 75 (The Sewage Utilization Act, 1865); 29 and 30 Vict., c. 90 (The Sanitary Act, 1866); 30 and 31 Vict., c. 113 (The Sewage Utilization Act, 1867; and 31 and 32 Vict., c. 115 (The Sanitary Act, 1868); and 32 and 33 Vict., c. 100 (The Sanitary Loans Act, 1869), as applied to Ireland by 34 and 35 Vict., c. 109, and 35 and 36 Vict., c. 69 :

“Nuisances Removal Acts” means 18 and 19 Vict., c. 121 (The Nuisances Removal Act for England, 1855); 23 and 24 Vict., c. 77 (An Act to amend the Acts for the removal of Nuisances and the prevention of Diseases); 26 and 27 Vict., c. 117 (The Nuisances Removal Act for England (Amendment) Act, 1863); 29 and 30 Vict., c. 41 (The Nuisances Removal Act (No. 1), 1866); 29 and 30 Vict., c. 90 (The Sanitary Act, 1866), as

amended by 32 and 33 Viet., c. 108; and the Sanitary Act, 1868, as applied to Ireland by 34 and 35 Vict., c. 109, and 35 and 36 Viet., c. 69:

“Sanitary Acts” means all the above mentioned acts and this act, and includes any amendments of such acts, and with respect to any urban sanitary district, includes any act, local act, or provisional order relating to the same subject matters as the above-mentioned acts in force within such district:

“Sanitary purposes” means any objects or purposes of the Sanitary Acts:

“Sanitary authority” means either “urban or rural sanitary authority”:

“Lands Clauses Acts” means and includes the Lands Clauses Consolidation Act, 1845, as the same is amended by the Lands Clauses Consolidation Acts Amendment Act, 1860, the Railways Act (Ireland), 1851, the Railways Act (Ireland), 1860, the Railways Act (Ireland), 1864, and the Railway Traverse Act:

“Poor Law Acts” means 1 and 2 Viet., c. 56, and the acts amending the same:

“Medical Charities Acts” means 14 and 15 Viet., c. 68, and the acts amending the same.

THE SANITARY ACT, 1866.

29 and 30 VICTORIA, CAP. 90.

An Act to Amend the Law relating to the Public Health.

[7th August, 1866.]

Whereas it is expedient to amend the Law relating to Public Health: Be it enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Preliminary.

Short title of Act.

1. This Act may be cited for all purposes as *The Sanitary Act, 1866.*^a

PART I. *b*

Amendment of the Sewage Utilization Act, 1865.

Definition of “Sewer Authority.”

2. “Sewer Authority” in this Act shall have the same meaning as it has in the Sewage Utilization Act, 1865.^c

^a An Amendment for England of this Act, 31 and 32 Vic., c. 115, was extended to Ireland by the 23rd Sec., Local Government (Ireland) Act, 1871

^b In the application to Ireland of the first part of this Sanitary Act, the changes required by sec. 56 must be observed.

^c This definition of Sewer Authority has been amended further as regards Ireland

The words "Lord Lieutenant in Council" shall mean in this Act the Lord Lieutenant or any Chief Governor or Chief Governors in Ireland, acting by and with the consent of her Majesty's Privy Council in Ireland. "Lord Lieutenant in Council."

3. This part of this Act shall be construed as one with the Sewage Utilization Act, 1865, and the expression, "The Sewage Utilization Act, 1865," as used in this or any other Act of Parliament or other document, shall mean the said Sewage Utilization Act, 1865, as amended by this Act. This part to be construed with 28 and 29 Vic., c. 75.

[This section, by incorporating the Sewage Utilization Act with this Act, considerably enlarges the powers which were conferred on the Authorities; for instance, the jurisdiction of Boards of Guardians was limited by the Schedule of the Sewage Utilization Act to "any town or village in any Union not included in the above descriptions;" but by the Schedule to this Sanitary Act their jurisdiction is enlarged to "such part of each Union as is not under another Sewer or Nuisance Authority." By a comparison of these two Schedules, the exact enlargement of the powers of the Authorities will be seen.]

4. Any *a* Sewer Authority may from time to time, at any Meeting specially convened for the purpose, form one or more Committee or Committees consisting wholly of its own Members, *b* or partly of its own Members and partly of such other Persons contributing to the Rate or Fund out of which the expenses incurred by such authority are paid, and qualified in such other manner as the Sewer Authority may determine, and may delegate, with or without conditions or restrictions, to any Committee so formed all or any powers of such Sewer Authority, and may from time to time revoke, add to, or alter any powers so given to a Committee. Power to Sewer Authority to form Committee of its own members and others.

A Committee may elect a Chairman of its Meetings. If no Chairman is elected, or if the Chairman elected is not present at the time appointed for holding the same, the Members present shall choose one of their number to be Chairman of such Meeting. A Committee may meet and adjourn as it thinks proper. The quorum of a Committee shall consist of such number of Members as may be prescribed by the Sewer Authority that appointed it, or, if no number be prescribed, of three Members. Every question at a Meeting shall be determined by a majority of votes of the members present, and voting on that question; and in case of an equal division of votes, the Chairman shall have a second or casting vote.

The proceedings of a Committee shall not be invalidated by any vacancy or vacancies amongst its Members.

A Sewer Authority may from time to time add to or diminish the number of the Members, or otherwise alter the constitution of any Committee formed by it, or dissolve any Committee.

A Committee of the Sewer Authority shall be deemed to be the agents of that Authority, and the appointment of such Committee shall not relieve the Sewer Authority from any obligation imposed on it by Act of Parliament or otherwise. *c*

[Sections 5, 6, and 7 are hardly applicable in Ireland.]

by section 56, which provides that the Sewer Authority in Ireland shall be that contained in the first Schedule to this Act. The "Sewer Authority" in Ireland is also invested with powers to execute the Nuisances Removal Acts (sec. 57), to which Part II. of this Sanitary Act relates, and to execute the powers conferred on the Local Boards of Health by the English Acts (see secs. 11 and 42); and the powers of all these authorities have finally been transferred to the Urban and Rural Sanitary Authorities by the Public Health Act of 1874.

a See sec. 5 of the Nuisances Removal Act, 1855.

b The power to associate persons not members of the local authority with members of it evidently no longer exists. (See Public Health Act, 1874.)

c The Public Health Act, 1874, makes no reference to the appointment of committees; but presumably they may be constituted.

Formation
of Special
Drainage
District.

5. Where the Sewer Authority of a District is a Vestry, Select Vestry, or other Body of Persons acting by virtue of any Act of Parliament, prescription, custom, or otherwise, as or instead of a Vestry or Select Vestry, it may, by resolution at any Meeting convened for the purpose after twenty-one clear days' notice affixed to the places where parochial notices are usually affixed in its district, form any part of such district into a Special Drainage District for the purposes of the Sewage Utilization Act, and thereupon such Special Drainage District shall, for the purposes of the Sewage Utilization Act, 1865, and the powers therein conferred, be deemed to be a parish in which a rate is levied for the maintenance of the poor, and of which a Vestry is the Sewer Authority; subject, as respects any Meeting of the inhabitants thereof in Vestry, to the Act of the Fifty-eighth Year of the Reign of King *George the Third*, Chapter Sixty-nine, and the Acts amending the same; and any officer or officers who may from time to time be appointed by the Sewer Authority of such Special Drainage District for the purpose shall have within that district all the powers of levying a rate for the purpose of defraying the expense of carrying the said Sewage Utilization Act into effect that they would have if such district were such parish as aforesaid, and such rate were a rate for the relief of the poor, and they were duly appointed overseers of such parish.

Appeal
against
constitution
of Special
Drainage
District.

6. Where the Sewer Authority of any place has formed a Special Drainage District in pursuance of this Act, if any number of the inhabitants of such place, not being less than twenty, feel aggrieved by the formation of such District, or desire any modification in its boundaries, they may, by petition in writing under their hands, bring their case under the consideration of one of her Majesty's principal Secretaries of State, and the said Secretary of State may after due investigation annul the formation of the Special Drainage District, or modify its boundaries as he thinks just.

Evidence of
formation
of Special
Drainage
District.

7. A copy of the resolution of a Sewer Authority forming a Special Drainage District shall be published by affixing a Notice thereof to the Church Door of the Parish in which the District is situate, or of the adjoining Parish if there be no Church in the said Parish, and by advertising Notice thereof in some Newspaper published or circulating in the County in which such District is situate; and the production of a Newspaper containing such Advertisement, or a Certificate under the hand of the Clerk or other Officer performing the duties of Clerk for the time being of the Sewer Authority which passed the Resolution forming the District, shall be evidence of the formation of such District, and after the expiration of three months from the date of the resolution forming the District, such District shall be presumed to have been duly formed, and no objection to the formation thereof shall be entertained in any legal proceedings whatever.

Power to
drain into
sewers of
Sewer
Authority.

8. Any Owner^a or Occupier of Premises within the District of a Sewer Authority shall be entitled to cause his drains to empty into Sewers of that Authority, on condition of his giving such Notice as may be required by that Authority of his intention so to do, and of complying with the regulations of that Authority in respect of the mode in which the communications between such Drains and Sewers are to be made, and subject to the control of any person who may be appointed by the Sewer Authority to superintend the making of such

^a "Owner" in this and the second part of the act has the same meaning, *vide* 31 and 32 Vic, c. 115, sec. 11.

communications: but any person causing any Drain to empty into any Sewer of a Sewer Authority without complying with the provisions of this Section shall incur a penalty not exceeding twenty pounds, and it shall be lawful for the Sewer Authority to close any communication between a Drain and Sewer made in contravention of this Section, and to recover in a summary manner from the person so offending any expenses incurred by them under this Section.

9. Any Owner or Occupier of Premises beyond the limits of the district of a Sewer Authority may cause any sewer or drain from such premises to communicate with any sewer of the Sewer Authority upon such terms and conditions as may be agreed upon between such Owner or Occupier and such Sewer Authority, or in case of dispute may, at the option of the owner or occupier, be settled by two Justices or by arbitration, in manner provided by the Public Health Act, 1848, in respect of matters by that Act authorised or directed to be settled by arbitration. *a*

Use of
sewers by
persons beyond
district.

10. If a dwelling house within the district of a Sewer Authority is without a drain, or without such drain as is sufficient for effectual drainage, the Sewer Authority may by notice require the owner of such house, within a reasonable time therein specified, to make a sufficient drain emptying into any sewer which the Sewer Authority is entitled to use, and with which the owner is entitled to make a communication, so that such sewer be not more than one hundred feet from the site of the house of such owner; but if no such means of drainage are within that distance, then emptying into such covered cesspool or other place, not being under any house, as the Sewer Authority directs; and if the person on whom such notice is served fails to comply with the same, the Sewer Authority may itself, at the expiration of the time specified in the notice, do the work required, and the expenses incurred by it in so doing may be recovered from such owner in a summary manner.

As to the
drainage of
houses.

11. A Sewer Authority within its district shall have the same powers in relation to the supply of water that a Local Board has within its district, and the provisions of the sections hereinafter mentioned shall apply accordingly in the same manner as if in such provision "Sewer Authority" were substituted for "Local Board of Health" or "Local Board," and the district in such provisions mentioned were the district of the Sewer Authority and not the district of the Local Board; that is to say, the sections numbered from seventy-five to eighty, both inclusive, of the Public Health Act, 1848, sections fifty-one, fifty-two, and fifty-three of the Local Government Act, 1858, and section twenty of the Local Government Act, 1858, Amendment Act, 1861.

Supply of
water to
District of
Sewer
Authority.

The Sewer Authority may, if it think it expedient so to do, provide a supply of water for the use of the inhabitants of the districts by

- (1.) Digging wells;
- (2.) Making and maintaining reservoirs;
- (3.) Doing any other necessary acts;

and they may themselves furnish the same, or contract with any other persons or companies to furnish the same: provided always, that no land be purchased or taken under this clause except by agreement or in manner provided by the Local Government Act, 1858. *b*

It is also provided by sec. 49 of this Act that where a complaint is made to the Lord Lieutenant that a Sewer Authority has made default in providing its district with a proper supply of water, the Lord Lieutenant, on the complaint being proved, may make an order limiting the time for the performance of its duty by the Authority in the mat-

a See 11 and 12 Vic., c. 63, secs. 123 to 128.

b Sec Sec. 7 of Sewage Utilization Act, 1865.

Expenses
of Sewer
Authority
in supplying
water.

Wells, &c.,
belonging to
any place
vested in
Sewer
Authority, &c.,
23 and 24 Vic.,
c. 77, s. 7.

ter of such complaint; and if such duty be not performed within the time so limited, the Lord Lieutenant may appoint some person to perform the same at the cost of the Authority in default.

12. Any expenses incurred by a Sewer Authority in or about the supply of water to its district, and in carrying into effect the provisions herein before in that behalf mentioned, shall be deemed to be expenses incurred by that Authority in carrying into effect the Sewage Utilization Act, 1865, and be payable accordingly.^a

13. All property in wells, fountains, and pumps, and powers in relation thereto, vested in the Nuisance Authority by the seventh section of the Act passed in the session of the twenty-third and twenty-fourth years of the reign of her present Majesty, chapter seventy-seven, shall vest in the Sewer Authority, where the Sewer Authority^b supplies water to its district.

PART II.

Amendment of the Nuisances Removal Acts.

Definition of
"Nuisances
Removal
Acts."

14. The expression "Nuisances Removal Acts" shall mean the Acts passed in the years following of the reign of her present Majesty; that is to say, the one in the session of the eighteenth and nineteenth years, chapter one hundred and twenty-one, and the other in the session of the twenty-third and twenty-fourth years, chapter seventy-seven, as amended by this part of this Act; ^c and this part of this Act shall be construed as one with the said Acts; and all expenses incurred by a Nuisance Authority in carrying into effect any of the provisions of this part of this Act shall be deemed to be expenses incurred by it in carrying into effect the Nuisances Removal Acts.

Definition of
"Nuisance
Authority."
Power of Police
with respect to
nuisances.

15. "Nuisance Authority" shall mean any authority empowered to execute the Nuisances Removal Acts.

16. In any place within the jurisdiction of a Nuisance Authority the chief officer of police within that place, by and under the directions of one of her Majesty's principal Secretaries of State, ^d on its being proved to his satisfaction that the Nuisance Authority has made default in doing its duty, may institute any proceeding which the Nuisance Authority of such place might institute with respect to the removal of nuisances: provided always, that no officer of police shall be at liberty to enter any house or part of a house used as the dwelling of any person without such person's consent, or without the warrant of a justice of the peace, for the purpose of carrying into effect this Act.

Sect. 3 of
23 and 24 Vic.,
c. 77, repealed.

17. The third section of the said Act of the session of the twenty-third and twenty-fourth years of the reign of her present Majesty, chapter seventy-seven, shall be repealed, and all powers vested in any Highway Board or "Nuisance Removal Committee" under the Nuisance Removal Acts shall determine, and all property belonging to them for the purposes of the said Nuisances Removal Acts shall, subject to any debts or liabilities affecting the same, be transferred to or vested in the Nuisance Authority under the said acts: provided always, that this section shall not extend to any Vestry or District Board under the Act of the session of eighteenth and nineteenth years of the reign of her present Majesty, chapter one hundred and twenty, intituled *An Act for the better Local Management of the Metropolis*, or

18 and 19 Vict.,
c. 120.

^a See Section 6 of the Sewage Utilization Act, 1865, and 37 and 38 Vic., c. 93, sec. 44.

^b Now Local Sanitary Authority.

^c See also 26 and 27 Vic., c. 117.

^d Now Local Government Board. See also 37 and 38 Vic., c. 93, sec. 36.

to any committee appointed by such Vestry or District Board for the purpose of carrying into effect the Nuisances Removal Acts or any of them.

18. A requisition in writing under the hands of any ten inhabitants of a place shall, for the purposes of the twenty-seventh section of "The Nuisances Removal Act for England, 1855," be deemed to be equivalent to the certificate of the medical officer or medical practitioners therein mentioned, and the said section shall be enforced accordingly. ^a

Requisition of ten inhabitants equivalent to certificate of Medical Officer.

19. The word "Nuisances"^a under the Nuisance Removal Acts shall include,

Addition to definition of nuisance.

(1.) Any house or part of a house so over-crowded as to be dangerous or prejudicial to the health of the inmates:

(2.) Any factory, workshop, or workplace not already under the operation of any general Act for the Regulation of Factories or Bake-houses, not kept in a cleanly state, or not ventilated in such a manner as to render harmless as far as practicable any gases, vapours, dust, or other impurities generated in the course of the work carried on therein that are a nuisance or dangerous to health, or so over-crowded while work is carried on as to be dangerous or prejudicial to the health of those employed therein:

(3.) Any fireplace or furnace which does not, as far as practicable, consume the smoke arising from the combustible used in such fireplace or furnace, and is used within the district of a Nuisance Authority for working engines by steam, or in any mill, factory, dye-house, brewery, bakehouse, or gaswork, or in any manufactory or trade process whatsoever.

[The following caution has been extensively served by the Nuisance Authority in Dublin, on manufacturers:—

CORPORATION OF DUBLIN.

PUBLIC HEALTH COMMITTEE.

City Hall, Dublin,

1870.

SIR,—I am directed by the Public Health Committee to call your immediate attention to the great nuisance caused to the inhabitants of the neighbourhood of your by the dense volumes of black smoke which issue from the chimney belonging thereto, and to request that this serious inconvenience may be abated without delay.

The Committee wish to point your attention to the provisions of the 29th and 30th Vic., cap. 90, sec. 19, clause 4, and to inform you that the adoption of an efficient system of stoking would not only tend to abate the annoyance, but would cause a considerable saving in the consumption of fuel; results with which such a course has already, in some instances, been attended.

I am, Sir, your most obedient servant,

Officer of Health Committee.]

4. Any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance:

Provided, first, that in places where at the time of the passing of this Act no enactment is in force compelling fire-places or furnaces to consume their own smoke, the foregoing enactment as to fireplaces and furnaces consuming their own smoke shall not come into operation until the expiration of one year from the date of the passing of this Act:

^a For definition of nuisance, see Sec. 8, Nuisances Removal Act, 1865.

Secondly, that where a person is summoned before the Justices in respect of a nuisance arising from a fireplace or furnace which does not consume the smoke arising from the combustible used in such fireplace or furnace, the justices may hold that no nuisance is created within the meaning of this Act, and dismiss the complaint, if they are satisfied that such fireplace or furnace is constructed in such manner as to consume, as far as practicable, having regard to the nature of the manufacture or trade, all smoke arising therefrom, and that such fireplace or furnace has been carefully attended to by the person having the charge thereof.

Duties of
Nuisance
Authorities
as to
inspection of
nuisances,
&c.

20. It shall be the duty of the Nuisance Authority to make from time to time, either by itself or its officers, inspection of the district, with a view to ascertain what nuisances exist calling for abatement under the powers of the Nuisance Removal Acts, and to enforce the provisions of the said Acts in order to cause the abatement thereof; also to enforce the provisions of any Act that may be in force within its district requiring fireplaces and furnaces to consume their own smoke; and any justice upon complaint upon oath may make an order to admit the Nuisance Authority or their officers for these purposes, as well as to ground proceedings under the eleventh section of the Nuisances Removal Act, 1855.

As to
proceedings
of Nuisance
Authority
under sect.
12 of 18 and 19
Vict., c. 121.

21. The Nuisance Authority or Chief Officer of Police shall, previous to taking proceedings before a justice under the twelfth section of the Nuisances Removal Act, 1855, serve a notice on the person by whose act, default, or sufferance the nuisance arises or continues, or, if such person cannot be found or ascertained, on the owner or occupier of the premises on which the nuisance arises, to abate the same, and for that purpose to execute such works and to do all such things as may be necessary within a time to be specified in the notice: provided,

First, that where the nuisance arises from the want or defective construction of any structural convenience, or where there is no occupier of the premises, notice under this section shall be served on the owner:

Secondly, that where the person causing the nuisance cannot be found, and it is clear that the nuisance does not arise or continue by the act, default, or sufferance of the owner or occupier of the premises, then the Nuisance Authority may itself abate the same without further order, and the cost of so doing shall be part of the costs of executing the Nuisances Removal Acts, and borne accordingly.

Power to cause
premises to
be cleansed
or otherwise
disinfected.

22. If the Nuisance Authority shall be of opinion, upon the certificate of any legally qualified medical practitioner, that the cleansing and disinfecting of any house or part thereof, and of any articles therein likely to retain infection, would tend to prevent or check infectious or contagious disease, it shall be the duty of the Nuisance Authority to give notice in writing requiring the owner or occupier of such house or part thereof to cleanse and disinfect the same as the case may require; and if the person to whom notice is so given fail to comply therewith within the time specified in the notice, he shall be liable to a penalty of not less than one shilling and not exceeding ten shillings for every day during which he continues to make default; and the Nuisance Authority shall cause such house or part thereof to be cleansed and disinfected, and may recover the expenses incurred from the owner or occupier in default in a summary manner. When the owner or occupier of any such house or part thereof as is referred to in this section is from poverty or otherwise unable, in the opinion of the Nuisance Authority, effectually to carry out the requirements of this section, such Authority may, without enforcing such requirements on such owner or occupier, with his consent, at its own expense,

cleanse and disinfect such house or part thereof and any articles therein likely to retain infection.

23. The Nuisance Authority in each district may provide a proper place, with all necessary apparatus and attendance, for the disinfection of woollen articles, clothing, or bedding which have become infected, and they may cause any articles brought for disinfection to be disinfected free of charge.

Power to provide means of disinfection.

24. It shall be lawful at all times for the Nuisance Authority to provide and maintain a carriage or carriages suitable for the conveyance of persons suffering under any contagious or infectious disease, and to pay the expense of conveying any person therein to an hospital or place for the reception of the sick or to his own home.

Nuisance Authorities may provide carriages for conveyance of infected persons.

25. If any person suffering from any dangerous infectious disorder shall enter any public conveyance without previously notifying to the owner or driver thereof that he is so suffering, he shall on conviction thereof before any justice be liable to a penalty not exceeding five pounds, and shall also be ordered by such justice to pay to such owner and driver all the losses and expenses they may suffer in carrying into effect the provisions of this Act; and no owner or driver of any public conveyance shall be required to convey any person so suffering until they shall have been first paid a sum sufficient to cover all such losses and expenses. *a*

Penalty on person suffering from infectious disorder entering public conveyance without notifying to driver that he is so suffering.

26. Where an hospital or place for the reception of the sick is provided within the district of a Nuisance Authority, any justice may, with the consent of the superintending body of such hospital or place, by order on a certificate signed by a legally qualified medical practitioner, direct the removal to such hospital or place for the reception of the sick, at the cost of the Nuisance Authority, of any person suffering from any dangerous contagious or infectious disorder, being without proper lodging or accommodation, or lodged in a room occupied by more than one family, or being on board any ship or vessel.

Removal of persons sick of infectious disorders, and without proper lodging, in any district

27. Any Nuisance Authority may provide a proper place for the reception of dead bodies, and where any such place has been provided and any dead body of one who has died of any infectious disease is retained in a room in which persons live or sleep, or any dead body which is in such a state as to endanger the health of the inmates of the same house or room is retained in such house or room, any justice may, on a certificate signed by a legally qualified medical practitioner, order the body to be removed to such proper place of reception at the cost of the Nuisance Authority, and direct the same to be buried within a time to be limited in such order; and unless the friends or relations of the deceased undertake to bury the body within the time so limited, and do bury the same, it shall be the duty of the Relieving Officer to bury such body at the expense of the Poor Rate, but any expense so incurred may be recovered by the Relieving Officer in a summary manner from any person legally liable to pay the expense of such burial.

Places for the reception of dead bodies may be provided at the public expense.

28. Any Nuisance Authority may provide a proper place (otherwise than at a workhouse or at a mortuary house, as lastly hereinbefore provided for) for the reception of dead bodies for and during the time required to conduct any *post-mortem* examination ordered by the

Places for reception of dead bodies during time required for *post-mortem* examination may be provided.

a These losses and expenses, as detailed in section 28, are incurred in having the conveyance thoroughly disinfected after it has conveyed any such sufferer. The previous section (24) enables the authority to guard against the spread of infection in this manner, by providing carriages for the conveyance of persons to the hospitals or to their own homes, and Section 54, Public Health (Ireland) Act, enables the Sanitary Authority to order the destruction of any clothing, bedding, &c., infected, and to compensate the owner thereof.

b See section 54, 27 and 28 Vic., c. 93.

Coroner of the district or other constituted authority, and may make such regulations as they may deem fit for the maintenance, support, and management of such place; and where any such place has been provided, any Coroner or other constituted authority may order the removal of the body for carrying out such *post-mortem* examination and the re-removal of such body, such costs of removal and re-removal to be paid in the same manner and out of the same fund as the cost and fees for *post-mortem* examinations when ordered by the Coroner.

Power to remove to hospital sick persons brought by ships.

29. Any Nuisance Authority may, with the sanction of the Privy Council, *a* signified in manner provided by "The Public Health Act, 1858," lay down rules for the removal to any hospital to which such Authority is entitled to remove patients, and for keeping in such hospital so long as may be necessary any persons brought within their district by any ship or boat, who are infected with a dangerous and infectious disorder, and they may by such rules impose any penalty not exceeding five pounds on any person committing any offence against the same.

Provision as to district of Nuisance Authority extending to places where ships are lying

30. For the purposes of this Act any ship, vessel, or boat that is in a place not within the district of a Nuisance Authority shall be deemed to be within the district of such Nuisance Authority as may be prescribed by the Privy Council, and until a Nuisance Authority has been prescribed, then of the Nuisance Authority whose district nearest adjoins the place where such ship, vessel, or boat is lying, the distance being measured in a straight line; but nothing in this act contained shall enable any Nuisance Authority to interfere with any ship, vessel, or boat that is not in *British* waters.

Power of entry to Nuisance Authority or their officer under sec. 11 of 18 and 19 Vic, c. 121.

31. The power of entry given to the authorities by the eleventh section of the Nuisances Removal Act, 1855, may be exercised at any hour when the business in respect of which the nuisance arises is in progress or is usually carried on.

And any justice's order once issued under the said section shall continue in force until the nuisance has been abated, or the work for which the entry was necessary has been done.

Provision as to ships within the jurisdiction of Nuisance Authority.

32. Any ship or vessel lying in any river, harbour, or other water shall be subject to the jurisdiction of the Nuisance Authority *b* of the district within which such river, harbour, or other water is, and be within the provisions of the Nuisances Removal Acts, in the same manner as if it were a house within such jurisdiction, and the master or other officers in charge of such ship shall be deemed for the purposes of the Nuisances Removal Acts to be the occupier of such ship or vessel; but this section shall not apply to any ship or vessel belonging to her Majesty or to any foreign government.

Provision for raising money in divided parishes.

33. Where the Guardians are the Nuisance Authority for part of any parish only, and shall require to expend money on account of such part in execution of the provisions of the said acts, the overseers of the parish shall, upon receipt of the order from the said Guardians, raise the requisite amount from the persons liable to be assessed to the poor rate therein by a rate to be made in like manner as a poor rate, and shall have all the same powers of making and recovering the same, and of paying the expense of collecting the rate when made, and shall account to the auditor of the district for receipt and disbursement of the same, in like manner, and with the same consequences, as in the case of the poor rate made by them.

Nuisance Authority may require payment of costs or expenses from owner or occupier, and occupier paying to deduct from rent.

34. That it shall be lawful for the Nuisance Authority, at their dis-

a Local Government Board.

b When districts of several sanitary authorities abut upon a port or river, the Local Government Board may, if the introduction of contagious disease be apprehended, appoint one of the local authorities to be the sole sanitary authority for the port or river.

cretion, to require the payment of any costs or expenses which the owner of any premises may be liable to pay under the said Nuisance Removal Acts or this act, either from the owner or from any person who then or at any time thereafter occupies such premises, and such owner or occupier shall be liable to pay the same, and the same shall be recovered in manner authorized by the Nuisance Removal Acts,^a and the owner shall allow such occupier to deduct the sums of money which he so pays out of the rent from time to time becoming due in respect of the said premises, as if the same had been actually paid to such owner as part of such rent: provided always, that no such occupier shall be required to pay any further sum than the amount of rent for the time being due from him, or which, after such demand of such costs or expenses from such occupier, and after notice not to pay his landlord any rent without first deducting the amount of such costs or expenses, becomes payable by such occupier, unless he refuse, on application being made to him for that purpose by or on behalf of the Nuisance Authority, truly to disclose the amount of his rent and the name and address of the person to whom such rent is payable; but the burden of proof that the sum demanded from any such occupier is greater than the rent due by him at the time of such notice, or which has since accrued, shall lie upon such occupier: provided also, that nothing herein contained shall be taken to affect any contract made or to be made between any owner or occupier of any house, building, or other property whereof it is or may be agreed that the occupier shall pay or discharge all rates, dues, and sums of money payable in respect of such house, building, or other property, or to affect any contract whatsoever between landlord or tenant.

PART III.^b

Miscellaneous.

35. c On application ^d to one of her Majesty's principal Secretaries of State by the Nuisance Authority ^e of the city of London, or any district or parish included within the act for the better local government of the metropolis, or of any municipal borough, or of any place under the Local Government Act, 1858, or any Local Improvement Act, or of any city or town containing, according to the census for the time being in force, a population of not less than five thousand inhabitants, the Secretary of State ^f may, as he may think fit, by notice to be published in the *London Gazette*, in Ireland the *Dublin Gazette*, ^g declare the following enactment to be in force in the district of such Nuisance Authority; and from and after the publication of such notice, the Nuisance Authority shall be empowered to make regulations for the following matters, that is to say,

In cities, boroughs, or towns, Secretary of State, on application of Nuisance Authority, may empower them to make regulations as to lodging houses.

^a See Sections 19 and 20 of the Act 18 and 19 Vict., c. 121.

^b In the application of this part of the Sanitary Act to Ireland, the changes prescribed by Sec. 61 must be observed.

^c See Section 51 Public Health Act, 1874.

^d The application mentioned in this section for power to make regulations as to lodging houses may be made by any Nuisance Authority, except a board of guardians (see Sec. 61), and must be made to the Local Government Board, who shall have the power of declaring the enactments as to lodging houses to be in force in any sanitary district.—Sec. 68.

^e For the purpose of this part of the act, Sewers and Nuisances Authorities in Ireland are incorporated.—Sec. 61.

^f In Ireland Local Government Board, read Section 61 of this act in conjunction with Public Health Act, 1874.

^g This notice as regards Irish enactments must be published in the *Dublin Gazette*, in accordance with Sec. 67.

1. For fixing the number of persons who may occupy a house or part of a house which is let in lodgings, or occupied by members of more than one family :
2. For the registration of houses thus let or occupied in lodgings :
3. For the inspection of such houses, and the keeping the same in a cleanly and wholesome state :
4. For enforcing therein the provision of privy accommodation, and other appliances and means of cleanliness, in proportion to the number of lodgings and occupiers, and the cleansing and ventilation of the common passages and staircases :
5. For the cleansing and lime-whiting at stated times of such premises.

The Nuisance Authority may provide for the enforcement of the above regulations by penalties not exceeding forty shillings for any one offence, with an additional penalty not exceeding twenty shillings for every day during which a default in obeying such regulations may continue ; but such regulations shall not be of any validity unless and until they shall have been confirmed by the Secretary of State.

But this section shall not apply to common lodging-houses within the provisions of the Common Lodging Houses Act, 1851, or any act amending the same.

Cases in which two convictions have occurred within three months.

36. Where two convictions against the provisions of any act relating to the over-crowding of a house, or the occupation of a cellar as a separate dwelling place, shall have taken place within the period of three months, whether the persons so convicted were or were not the same, it shall be lawful for any two justices to direct the closing of such premises for such time as they may deem necessary, and, in the case of the cellars occupied as aforesaid, to empower the Nuisance Authority to permanently close the same, in such manner as they may deem fit, at their own cost.

Power to provide hospitals.

37. The Sewer Authority, or in the metropolis the Nuisance Authority, may provide for the use of the inhabitants within its district hospitals or temporary places for the reception of the sick.

Such authority may itself build such hospitals or places of reception, or make contracts for the use of any existing hospital or part of an hospital, or for the temporary use of any place for the reception of the sick.

It may enter into any agreement with any person or body of persons having the management of any hospital for the reception of the sick inhabitants of its district, on payment by the Sewer Authority of such annual or other sums as may be agreed upon.

The carrying into effect this section shall in the case of a Sewer Authority be deemed to be one of the purposes of the said Sewage Utilization Act, 1865, and all the provisions of the said act shall apply accordingly.

Two or more authorities having respectively the power to provide separate hospitals may combine in providing a common hospital, and all expenses incurred by such authorities in providing such hospital shall be deemed to be expenses incurred by them respectively in carrying into effect the purposes of this act.

Penalty on any person with infectious disorder exposing himself, or on any person in charge of such sufferer causing such exposure.

38. Any person suffering from any dangerous infectious disorder who wilfully exposes himself, without proper precaution against spreading the said disorder, in any street, public place, or public conveyance, and any person in charge of one so suffering who so exposes the sufferer, and any owner or driver of a public conveyance who does not immediately provide for the disinfection of his conveyance after it has, with the knowledge of such owner or driver, conveyed any such sufferer, and any person who without previous disinfection gives, lends, sells, transmits, or exposes any bedding, clothing, rags, or other things which have been exposed to infection from such disorders, shall on conviction of such offence before any justice be

liable to a penalty not exceeding five pounds: provided that no proceedings under this section shall be taken against persons transmitting with proper precautions any such bedding, clothing, rags, or other things for the purpose of having the same disinfected.

39. If any person knowingly lets any house, room, or part of a house in which any person suffering from any dangerous infectious disorder has been, to any other person without having such house, room, or part of a house, and all articles therein liable to retain infection, disinfected to the satisfaction of a qualified medical practitioner as testified by a certificate given by him, such person shall be liable to a penalty not exceeding twenty pounds. For the purposes of this section the keeper of an inn shall be deemed to let part of a house to any person admitted as a guest into such inn.

Penalty on persons letting houses in which infected persons have been lodging.

40. When in any place two or more boards of guardians or local authorities have jurisdiction, the Privy Council may, by any order made under the Diseases Prevention Act, 1855, authorize or require such boards to act together for the purposes of that act, and may prescribe the mode of such joint action and of defraying the costs thereof.

Guardians, &c., of the poor to be the Local Authorities for executing Diseases Prevention Act.

41. In any proceedings under the Common Lodging Houses Act, 1851, if the inmates of any house or part of a house allege that they are members of the same family, the burden of proving such allegation shall lie on the persons making it.

Evidence of family in case of over-crowded houses.

[The opportunity afforded by the passing of this act was taken by the Legislature to introduce this section by way of amendment to the "Common Lodging Houses Act;" for, whenever the officer appointed visited these common lodging houses and found them to be over-crowded, it had been the practice of the keeper of the house, or room, to shield himself from penalties by pleading that the occupants were all members of the same family, and that consequently the house, or room, was exempt from the operation of the Common Lodging House Act and the bye-laws made thereunder. Now the *onus probandi* is laid upon the defendant.—*Byrne's Compendium of Sanitary Laws*, page 35.]

42. The sixty-seventh section of the Public Health Act, 1848, relating to cellar dwellings, shall apply to every place in *England and Ireland* where such dwellings are not regulated by any other Act of Parliament, and in applying that section to places where it is not in force at the time of the passing of this Act the expression "this Act" shall be construed to mean the "Sanitary Act, 1866," and not the said "Public Health Act, 1848." In construing the said sixty-seventh section as applied by this act, Nuisance Authority shall be substituted for the Local Board.

Extension to the whole of England and Ireland of sec. 67 of 11 and 12 Vict. c. 63.

43. Local Boards acting in execution of the Local Government Act, 1858, may adopt the act to encourage the establishment of public baths and wash-houses, and any act amending the same, for districts in which those acts are not already in force, and when they have adopted the said acts they shall have all the powers, duties, and rights of commissioners under the said acts; and all expenses incurred by any local board in carrying into execution the acts referred to in this section shall be defrayed out of the general district rates, and all receipts by them under the said acts shall be carried to the district fund account.

Local Board in certain cases may adopt Baths and Wash houses Acts.

44. When the district of a burial board is coterminous with the district of a local board of health, the burial board may, by resolution of the vestry, and by agreement of the burial board and local board, transfer to the local board all their estate, property, rights, powers, duties, and liabilities, and from and after such transfer the local board shall have all such estate, property, rights, powers, duties, and liabilities, as if the local board had been appointed a burial board by order in Council under the fourth section of the act of the session

Power of Burial Boards in certain cases to transfer their powers to Local Board.

Penalty for
wilful damage
of works.

Incorporation
of Sanitary
Authorities.

Extent of
authority to
make provisional
orders respecting
lands under
Sec. 75 of
21 and 22 Vict.,
cap. 98.

Appearance
of Local
Authorities
in legal
proceedings.

Mode of
proceeding
where Sewer
Authority
has made
default in
providing
sufficient sewers,
&c.

of the twentieth and twenty-first years of the reign of her present Majesty, chapter eighty-one. *a*

45. If any person wilfully damages any works or property belonging to any local board, sewer authority, or nuisance authority, he shall be liable to a penalty not exceeding five pounds.

46. The following bodies, that is to say, local boards, sewer authorities, and nuisance authorities, if not already incorporated, shall respectively be bodies corporate designated by such names as they may usually bear or adopt, with power to sue and be sued in such names, and to hold lands for the purposes of the several acts conferring powers on such bodies respectively in their several characters of local boards, sewer authorities, or nuisance authorities.

47. The authority conferred on one of her Majesty's principal Secretaries of State *b* by section seventy-five of the Local Government Act, 1858, to empower by provisional order a local board to put in force, with reference to the land referred to in such order, the powers of the Lands Clauses Consolidation Act, 1845, with respect to the purchase and taking of lands otherwise than by agreement, shall extend and apply and shall be deemed to have always extended and applied to every case in which by the Public Health Act, 1848, and the Local Government Act, 1858, or either of them, or any act extending or amending those acts, or either of them, a local board are authorised to purchase, provide, use, or take lands or premises for any of the purposes of the said acts, or either of them, or of any such act as aforesaid; and sections seventy-three and eighty-four of the Public Health Act, 1848, shall be construed as if the words "by agreement" therein respectively used had been expressly repealed by section seventy-five of the Local Government Act, 1858.

48. Any local board, sewer authority, or nuisance authority may appear before any justice or justices, or in any legal proceeding, by its clerk or by any officer or member authorised generally or in respect of any special proceeding by resolution of such board or authority, and such person being so authorised shall be at liberty to institute and carry on any proceeding which the nuisance authority is authorised to institute and carry on under the nuisance removal acts or this act.

49. Where complaint is made to one of her Majesty's principal Secretaries of State that a Sewer Authority or Local Board of Health has made default in providing its district with sufficient sewers, or in the maintenance of existing sewers, or in providing its district with a supply of water in cases where danger arises to the health of the inhabitants from the insufficiency or unwholesomeness of the existing supply of water, and a proper supply can be got at a reasonable cost, or that a Nuisance Authority has made default in enforcing the provisions of the Nuisance Removal Acts, or that a local board has made default in enforcing the provisions of the Local Government Act, the said Secretary of State, if satisfied after due inquiry made by him that the Authority has been guilty of the alleged default, shall make an order limiting a time for the performance of its duty in the matter of such complaint; and if such duty is not performed by the time limited in the order, the said Secretary of State shall appoint some person to perform the same, and shall by order direct that the expenses of performing the same, together with a reasonable remuneration to the person appointed for superintending such performance, and amounting to a sum specified in the order, together with the costs of the proceedings, shall be paid by the Authority in default; and any order made for

a This act appears to refer only to England.

b In Ireland the Local Government Board.

the payment of such costs and expenses may be removed into the Court of Queen's Bench, and be enforced in the same manner as if the same were an order of such court.

[The Local Government Board (Ireland) may enforce its orders on the Local Sanitary Authority by writ of mandamus. See 37 and 38 Vic., c. 93, sec. 37, and also 31 and 32 Vic., c. 115, sec. 8, and 32 and 33 Vic., c. 100.]

50. All expenses incurred by a Sewers Authority or Local Board in giving a supply of water to premises under the provisions of the seventy-sixth section of the Public Health Act, 1848, or the fifty-first section of the Local Government Act, 1858, and recoverable from the owners of the premises supplied, may be recovered in a summary manner.

Recovery of certain expenses of water supply.

51. All penalties imposed by the Act of the sixth year of King George the Fourth, chapter seventy-eight, intituled *An Act to repeal the several Laws relating to Quarantine, and to make other provisions in lieu thereof*, may be reduced by the justices or court having jurisdiction in respect of such penalties to such sum as the justices or court think just.

Power to reduce penalties imposed by 6 George IV., cap. 78.

52. Every vessel having on board any person affected with a dangerous or infectious disorder shall be deemed to be within the provisions of the act of the sixth year of King George the Fourth, chapter seventy-eight, although such vessel has not commenced her voyage, or has come from or is bound for some place in the United Kingdom, and the Lords and others of her Majesty's Most Honourable Privy Council, or any three or more of them (the Lord President of the Council or one of her Majesty's principal Secretaries of State being one), may, by order or orders to be by them from time to time made, make such rules, orders, and regulations as to them shall seem fit, and every such order shall be certified under the hand of the clerk in ordinary of her Majesty's Privy Council, and shall be published in the *London Gazette*, and such publication shall be conclusive evidence of such order to all intents and purposes; and such orders shall be binding and be carried into effect as soon as the same shall have been so published, or at such other time as shall be fixed by such orders, with a view to the treatment of persons affected with cholera and epidemic, endemic, and contagious disease, and preventing the spread of cholera and such other diseases, as well as on the seas, rivers, and waters of the United Kingdom, and on the high seas within three miles of the coasts thereof, as on land; and to declare and determine by what Nuisance Authority or Authorities such orders, rules, and regulations shall be enforced and executed; and any expenses incurred by such Nuisance Authority or Authorities shall be deemed to be expenses incurred by it or them in carrying into effect the Nuisances Removal Acts.

Description of vessels within provisions of 6 G. iv., c. 78.

53. Where notice *a* has been given by the Nuisance Authority, or their officer or officers, for the periodical removal of manure or other

Periodical removal of manure in mews, &c.

No.

NOTICE. *a*

NUISANCE AUTHORITY *o*

Notice under 29th & 30th Vic., cap. 90, Sec. 53.

To the Owner or Occupier

of Premises at

You are hereby required by the said Nuisance Authority, pursuant to the provision of the Public Health Act, 29 and 30 Vict., cap. 90, sec. 53, periodically to remove as hereafter required all manure or other refuse matter, existing in the premises situated at No. _____ that is to say

in each _____ and that said premises be thoroughly cleansed and purified to the satisfaction of the Medical Officer of Health, or other officer of this Nuisance Authority.

a See also section 18 of Nuisances Removal Act, 1855.

refuse matter from mews, stables, or other premises (whether such notice shall be by public announcement in the locality or otherwise), and subsequent to such notice the person or persons to whom the manure or other refuse matter belongs shall not so remove the same, or shall permit a further accumulation, and shall not continue such periodical removal at such intervals as the Nuisance Authority, or their officer or officers shall direct, he or they shall be liable, without further notice, to a penalty of twenty shillings per day for every day during which such manure or other refuse matter shall be permitted to accumulate, such penalty to be recovered in a summary manner: provided always, that this section shall not apply to any place where the board of guardians or overseers of the poor are the Nuisance Authority.

Recovery of penalties.

54. Penalties under this act, and expenses directed to be recovered in a summary manner, may be recovered before two justices in manner directed by an act passed in the session holden in the eleventh and twelfth years of the reign of her Majesty Queen Victoria, chapter forty-three, intituled *An Act to facilitate the performance of the duties of Justices of the Peace out of Sessions within England and Wales, with respect to summary convictions and orders*, or any act amending the same.

[By sec. 60 these penalties and expenses are to be recovered in the manner directed by the Petty Sessions, Ireland, Act. They should be recovered as damages before a justice, and an action will not lie for their recovery.—*Blackburn v. Parkinson*, 28 L.J.M.C.N.S. 7.]

Powers of Act cumulative.

55. All powers given by this act shall be deemed to be in addition to and not in derogation of any other powers conferred on any local authority by Act of Parliament, law, or custom, and such authority may exercise such other powers in the same manner as if this act had not passed.

PART IV.

Application of Act to Ireland.

Modifications necessary for application of Part I. to Ireland.

56. In applying the first part of this act to *Ireland* the following changes shall be observed:—

- (1.) The provisions of the sections numbered from seventy-five to eighty, both included, of the Public Health Act, 1848, and sections fifty-one, fifty-two, and fifty-three of the Local Government Act, 1858, and section twenty of the Local Government Act, 1858, Amendment Act, 1861, referred to in the first part of this act, shall for all purposes connected with the execution of this act be extended to *Ireland*.
- (2.) The Sewage Utilization Act, 1865, shall be amended by substituting in *Ireland* the Sewer Authority, as defined by the first schedule to this act, for the Sewers Authority as defined by said act.

Modifications necessary for application of Part 2 to Ireland.

57. The Nuisance Removal Acts, as amended by the second part of this act, shall apply to *Ireland*: provided, however, that in such application the following changes shall be observed:—

And take notice, should you neglect or refuse to comply with the terms of this Notice, you are liable to a penalty of Twenty Shillings for every day during which such refusal or neglect continues.

And you are further apprized that summary proceedings will be taken without further notice for the enforcing of said penalties incurred as aforesaid.

Dated this

day of

, 18

Signed,

Officer (clerk or acting clerk only) of said Nuisance Authority.

- (1.) Sewer Authority as defined by the Sewage Utilization Act, 1865, and amended by this act, shall in *Ireland* be the Nuisance Authority for executing the Nuisance Removal Acts :
- (2.) The expenses of executing the Nuisance Removal Acts shall be defrayed out of the funds hereinafter provided :
- (3.) The penalties shall be recovered in the manner hereinafter provided :
- (4.) The expressions, "Mayor, Aldermen, and Burgesses," "Council," "Borough Rate," "Borough Fund," and "Town Rate," shall in the first schedule hereto have respectively the same meaning as in the acts for the regulation of Municipal Corporations in *Ireland* :
- (5.) For the purposes of the twenty-second section of the Nuisance Removal Act, 1855, the Nuisance Authority shall in *Ireland* have the power of entering land conferred by the Sewage Utilization Act, 1865, and shall have the same power of levying assessments under the said section that they have of levying any other rates they are authorized by law to impose.

58. In *Ireland*, the Nuisance Authority, not being the guardians ^a of the poor, shall pay all expenses incurred by them in carrying the Nuisance Removal Acts into effect out of the fund in the first schedule in that behalf mentioned, and where such fund arises wholly or in part from rates shall have, in addition to their existing powers of rating, all such powers for making and levying any extra rate, if necessary, respectively, as in the case of any rate authorized to be made under the provisions of the respective acts of parliament under which the Nuisance Authorities are constituted or authorized to levy rates; and all provisions of such acts respectively shall be applicable in respect thereof : provided that when the rates to be assessed by such authority are limited by law to a certain rateable amount, such limitation shall not apply or extend to expenses incurred in carrying this act into execution ; and it shall be lawful for such authority to assess the expenses under this act in addition to such limited assessment.

How expenses to be defrayed in *Ireland* when Nuisance Authority not a Board of Guardians.

59. In *Ireland*, a Nuisance Authority, being guardians of the poor, shall pay all expenses incurred by them in carrying this act into effect out of the poor rates of the union, and charge the same to the union, or any electoral division or electoral divisions thereof, in such manner as the Poor Law Commissioners shall from time to time, by general orders applicable to classes of cases, or by order in any particular case, direct.

When Board of Guardians is Nuisance Authority, how expenses to be defrayed in *Ireland*.

60. [This Section is repealed by 34 and 35 Vic., c. 109, s. 22, page 370.]

61. In applying the provisions of Part III. of this act to *Ireland* the following changes shall be observed :

Modifications necessary for application of Part 3 to *Ireland*.

- (1.) Application for power to make regulations as to lodging houses may be made by any Nuisance Authority except a Board of Guardians, and shall be made to the Lord Lieutenant ^b in Council, and the said Lord Lieutenant in Council shall have the power of declaring the enactments as to lodging-houses in the third part of this act to be in force in any Nuisance District ^c
- (2.) The said Lord Lieutenant in Council shall have and exercise the power, in respect of Boards of Guardians acting together, vested in the Privy Council by the said third part of this act. ^d
- (3.) In *Ireland*, any Nuisance Authority, except a Board of Guardians, may exercise the powers conferred on Local Boards

^a The Public Health Act, 1874, gives the guardians the same sanitary powers relative to nuisances, sewage, water, &c., that the town authorities possess.

^b Local Government Board. ^c See sec. 35, page 359. ^d See sec. 40, page 361.

acting in the execution of the Local Government Act, 1858, by the said third part of this act. *a*

(4.) Sewer and Nuisance Authorities in *Ireland* shall be incorporated for the purposes of this act by the names set forth in the said first schedule hereto; and such Sewer or Nuisance Authorities may hold lands by such names for the purposes of Burial Ground (*Ireland*) Act, 1856:

(5.) The penalties under the third part of this act shall be recovered in like manner as herein before provided with respect to penalties under the second part of this act. *b*

Extension of
Disease
Prevention
Acts and this
Act to
Ireland.
Modifications
necessary for
application
of said Acts to
Ireland.

62. The Diseases Prevention Act, 1855, as amended by the Nuisance Removal and Disease Prevention Amendment Act, 1860, and this act, shall extend to *Ireland*: provided, however, that in such application the following changes shall be observed:

(1.) The Lord Lieutenant in Council shall have the power with respect to *Ireland* which the Privy Council has under such provisions for prevention of disease in *England*.

(2.) The commissioners for administering the laws for the relief of the poor in *Ireland*, hereinafter called the Poor Law Commissioners, shall be the authority in *Ireland* for issuing regulations to carry the provisions of said act into effect.

(3.) The regulations of the Poor Law Commissioners shall be authenticated in like manner as orders of theirs under the Dispensary Act, 1851, statute 14 and 15 *Vict.*, c. 68, *Sec. 2*.

(4.) In defraying the expenses of the prevention of disease out of the poor rate of the union under this act the guardians of the poor shall charge the same to the union, or any Dispensary District or Electoral Division or Divisions thereof, in such manner as the Poor Law Commissioners shall from time to time, by general orders applicable to classes of cases, or by orders in particular cases, direct.

Committee
and Officers
under
Dispensaries
Act to aid
Local
Authority in
execution of
this Act.

63. In *Ireland*, all committees, inspectors, medical officers, and other persons appointed or employed under the powers of statute fourteenth and fifteenth *Victoria*, chapter sixty-eight (the Dispensaries Act, 1851), shall and they are hereby required within their respective districts to aid the local authority, and such officers or persons as they shall appoint or employ, in the superintendence and execution of any directions and regulations which may at any time be issued by the Poor Law Commissioners for the time being under the authority and by virtue of this act.

The provisions
of 14 and 15
Vict., c. 68, as to
duties and ap-
pointment of
Medical Inspec-
tors in *Ireland*
incorporated
with this
Act.

64. In *Ireland*, the provisions of the Dispensary Act, 1851 (statute 14 and 15 *Vict.*, c. 68), with respect to the duties and appointment of medical inspectors, shall be incorporated with this act, and the prevention of disease and inquiry into public health under this act shall be deemed one of the purposes for which such medical inspectors have been or may be appointed, in like manner as if its provisions had been referred to in the said act of 1851, instead of the provisions of the said Nuisances Removal and Diseases Prevention Act of 1848.

Remuneration
to Medical
Practitioners
for services
under the
directions and
regulations of
the Poor Law
Commissioners
in *Ireland*.

65. In *Ireland*, whenever in compliance with any direction or regulation of the Poor Law Commissioners which they may be empowered to make under the laws for the time being as to the public health, any medical officer of a union or dispensary district, or any other medical practitioner specially employed by the guardians for the purpose, shall perform any extra medical service in any union or part of a union, it shall and may be lawful for the guardians of the union to determine, subject to the approval of the said commissioners, and if they shall not approve the amount determined by the guardians, for the said commissioners to fix by order under their seal such remuneration.

a See sec. 43, page 361.

b See sec. 60, page 360.

neration, proportioned to the nature and extent of such services as aforesaid, as to them shall appear just and reasonable ; and the amount of such remuneration shall be paid to such medical officer or other medical practitioner by the guardians of the union out of the rates raised for the relief of the poor, and shall be charged either to the union at large, or to such part or parts of the union, according to the nature of the case, as the said Commissioners shall in each case direct.

[The Public Health (Ireland), Act, 1874, creates the Local Government—formerly Poor Law—Board, the supreme directive and controlling sanitary authority.]

66. The Lord Lieutenant in Council may from time to time direct the Poor Law Commissioners to cause to be made such inquiries as the Lord Lieutenant in Council see fit in relation to any matters concerning the public health in any place or places in *Ireland*, and the Poor Law Commissioners *a* shall report the result of such inquiries to the Lord Lieutenant in Council.

Poor Law
Commissioners
to make inquiries
as to public
health in
Ireland.

67. Publication shall be made in the *Dublin Gazette* in any case in *Ireland* where publication in the *London Gazette* is required in *England*.

Publication in
Ireland to be
in *Dublin*
Gazette.

68. All powers relating to the execution of this act in *England*, and by this act vested in one of her Majesty's principal Secretaries of State, shall with regard to the execution of this act in *Ireland*; in all cases not hereinbefore expressly provided for, be vested in the Lord Lieutenant or other Chief Governor or Governors of *Ireland*; and all powers relating to the execution of this act in *England*, and by this act vested in the Privy Council in *England*, shall, with regard to the execution of this act in *Ireland*, in all cases not hereinbefore expressly provided for, be vested in the Lord Lieutenant in Council in *Ireland*.

Powers in
Secretary of
State in *Eng'*land
to be exercised
in *Ireland* by
the Lord
Lieutenant in
Council.

69. From and after the passing of this act the acts set forth in the second schedule hereto shall be repealed, so far as they are still in force : provided always, that all proceedings commenced or taken under the said acts, and not yet completed, may be proceeded with under said acts, and that all contracts and works undertaken by virtue of said acts shall continue and be effective as if said acts had not been repealed.

Repeals of
statutes applic-
able to *Ireland*.

SCHEDULES.

FIRST SCHEDULE—APPLICATION TO IRELAND.

Description of Sewers and Nuisance Authority in Ireland.	Description of Sewers and Nuisance District in Ireland.	Corporate Name for the purpose of suing or being sued, or holding Property, under the Provisions of this Act.	Rate or Fund out of which Expenses incurred by Sewers or Nuisance Authority under this Act to be defrayed.
The Right Honourable the Lord Mayor, Aldermen, and Burgesses, acting by the Town Council.	The City of Dublin.	The Right Honourable the Lord Mayor, Aldermen, and Burgesses of the City of Dublin.	The Borough Rate or Borough Fund.
The Mayor, Aldermen, and Burgesses, acting by the Town Council.	Towns Corporate, with exception of Dublin.	The Mayor, Aldermen, and Burgesses of the City or Town of—	The Borough Rate or Borough Fund.
The Town Commissioners.	Towns having Town Commissioners, under "The Towns Improvement (Ireland) Act, 1854" (17 and 18 Vict., c. 113), or under any Local Act.	The Town Commissioners of—	Any Rate levied by the Commissioners.
The Township Commissioners.	Townships having Commissioners under Local Acts.	The Township Commissioners of—	
The Commissioners appointed by virtue of an Act made in the 9th Year of the Reign of George the Fourth, intituled "An Act to make Provision for the Lighting, Cleansing, and Watching of Cities and Towns Corporate and Market Towns in Ireland in certain cases."	Towns under such Commissioners.	The Lighting and Cleansing Commissioners of the Town of—	
The Municipal Commissioners.	Towns having Municipal Commissioners, under 3 & 4 Vict., c. 108.	The Municipal Commissioners of—	The Town Fund.
The Guardians of the Poor of each Union.	Such part of each Union as is not under another Sewer or Nuisance Authority.	The Guardians of the Poor of the — Union.	The Poor Rate of Union.

SECOND SCHEDULE.

Statutes Repealed.

Local Boards of Health Act for Ireland, 1818; Statute 58 Geo. III., cap. 47, ss. 10 to 15, inclusive.
 Officers of Health Act for Ireland, 1819; Statute 59 Geo. III., c. 41.
 Nuisance Removal and Disease Prevention Act, 1848.
 Nuisance Removal and Disease Prevention Act, 1849.

Local Government Board (Ireland) Act. 369

THE LOCAL GOVERNMENT BOARD (IRELAND) ACT, 1872.

35 and 36 VICTORIA, CAP. 69.

An Act for constituting a Local Government Board in Ireland, and vesting therein certain functions of the Lord Lieutenant, the Privy Council, and the Chief Secretary to the Lord Lieutenant, concerning the Public Health and Local Government, together with the powers and duties of the Commissioners for administering the Laws for the Relief of the Poor in Ireland.

[10th August, 1872.]

1. This act may be cited as "The Local Government Board (Ireland) Act, 1872." Short title.

2. A board shall be established, to be called the Local Government Board for Ireland (in this act referred to as "The Local Government Board"), and from and after the establishment of such board the Poor Law Commission shall cease to exist, and all powers and duties vested in or imposed on the Commissioners for administering the Laws for Relief of the Poor in Ireland by the several acts of Parliament relating to the relief of the poor and any other acts, or vested in or imposed on the Lord Lieutenant, the Privy Council, or on the Chief Secretary to the Lord Lieutenant by the enactments mentioned in the schedule annexed hereto, shall be transferred to and imposed on the said Local Government Board, and, except as otherwise provided by this act, shall be exercised and performed by such board in like manner and form, and subject to the same conditions, liabilities, and incidents respectively, as such powers and duties might before the passing of this act have been exercised and performed by the authorities in whom the same were then vested respectively, or as near thereto as circumstances admit. Establishment of Local Government Board for Ireland.

3. The Local Government Board shall consist of a president, being the Chief Secretary to the Lord Lieutenant for the time being, the Under Secretary to the Lord Lieutenant for the time being, together with a vice-president and two other commissioners, one of whom shall be qualified in like manner as the medical commissioner under the Medical Charities Act, to be appointed by her Majesty, and to hold office during the pleasure of her Majesty. Constitution of Local Government Board.

[Rest of clause relates to appointment of officers.]

4. A rule, order, or regulation made by the Local Government Board shall be valid if it is made under the seal of the Board, and signed by the president, or by the Under Secretary to the Lord Lieutenant, or by the vice-president, or by the two other members of the board, both signing; and the production of such *prima facie* evidence of any of the said rules, orders, or regulations shall, until the contrary is shown, be a sufficient proof that any such rule, order, or regulation of the Local Government Board was duly made.

5. [Transfers the power of all other authorities relative to the relief of the poor, graveyards, &c., to new Board.]

6. From and after the passing of this act, any auditor of poor law unions in Ireland, who shall be appointed to audit the accounts of other public bodies, in addition to the accounts of the boards of guardians of unions, shall not receive for that duty remuneration beyond the amount of his yearly salary, any enactment to the contrary notwithstanding, and every such enactment is hereby repealed; and the number of such auditors and the amount of their salaries shall be such as the Local Government Board shall determine from time to time, with the approval of the Lords Commissioners of her Majesty's Treasury: provided always, that the Local Government Board shall from time to time ascertain and determine what proportion of the salaries paid to the said auditors should be charged in respect of the Auditors.

370 *Local Government (Ireland) Act, 1871.*

audit of the accounts of such public bodies respectively, and the amount so ascertained in respect of each such body shall be payable by such body, and shall be paid accordingly to such bank or to such person as the said Commissioners of her Majesty's Treasury may direct.

Amendment of
Sanitary Act,
1866.

8. [Repealed by section 45, 73 and 38 Vict., c. 93.]

9. The sewer authority of any district not being guardians of the poor shall defray all expenses incurred by such sewer authority in carrying into effect the provisions of section thirty-seven of "The Sanitary Act, 1866," out of the funds and in the manner prescribed by section fifty-eight of the said act, as if the same were expenses incurred in carrying the Nuisance Removal Acts into effect.

10. [Relates to holding of fairs.]

11. [Refers to lighting of boroughs.]

Sec. 31 of 34 and
35 Vict., c. 109,
repealed.

12. [Repeals section thirty-one of the Local Government (Ireland) Act, 1871, and its provisions relating to the audit of accounts.]

SCHEDULE referred to in the foregoing act.

Subject.	Act.
Towns Improvement	17 & 18 Vict. c. 103.
Sanitary Act, 1866	29 & 30 Vict. c. 90.
Sewage Utilization Act, 1865 (as applied to Ireland)	28 & 29 Vict. c. 75.
Nuisances Removal Act, 1855 (as applied to Ireland)	18 & 19 Vict. c. 121.
Diseases Prevention Act, 1855 (as applied to Ireland)	18 & 19 Vict. c. 116.
Nuisances Removal and Diseases Prevention Amendment, 1860 (as applied to Ireland)...	23 & 24 Vict. c. 77.
Local Government (Ireland)	34 & 35 Vict. c. 109.
Sanitary Act Amendment, 1868 (as applied to Ireland)	31 & 32 Vict. c. 115.
Sanitary Loans Act, 1869 (as applied to Ireland)	32 & 33 Vict. c. 115.
Common Lodging House Act, 1860	23 Vict. c. 26.
Burial Grounds	19 & 20 Vict. c. 98.
Burial Grounds Amendment Act	23 & 24 Vict. c. 76.

THE LOCAL GOVERNMENT (IRELAND) ACT, 1871.

34 and 35 VICTORIA, CAP. 109.

An act to amend the Law relating to the Local Government of Towns and populous Places in Ireland.

[21st August, 1871.]

Short title.

1. This act may be cited for all purposes as the Local Government (Ireland) Act, 1871.

Amendment and Application of certain Acts relating to Public Health.

Repeal of
section 60 of
29 and 30 Vict.
c. 90.

Recovery of
penalties under
29 and 30 Vict.,
c. 90

22. The sixtieth section of the Sanitary Act, 1866, shall be and the same is hereby repealed, and in lieu thereof be it enacted, that in Ireland penalties under the said act and expenses or compensation thereby directed to be recovered in a summary manner, and nuisances and other offences liable to be prosecuted summarily, shall be recovered and prosecuted with respect to the police district of Dublin metropolis, subject and according to the provisions of any act regulating the

powers and duties of justices of the peace for such district or of the police of such district, and with respect to other parts of Ireland, before a justice or justices of the peace sitting in petty sessions, subject and according to the provisions of the Petty Sessions (Ireland) Act, 1851, and any act amending the same, and all penalties recovered by any authority under the said act shall be paid to them respectively, and by them applied in aid of their expenses under the said act.

Any order authorised to be made by justices under the said act shall be deemed to be an order made upon a complaint on which justices are authorised to make orders under the said acts.

23. The provisions of the Sanitary Act, 1868, and the Sanitary Loans Act, 1869, shall, notwithstanding anything in the said acts to the contrary, apply to Ireland, with the modifications following; that is to say, the term "sewer authority" in the said acts shall have the same meaning that it has in the Sanitary Act, 1866; the term "local rate" in the said acts shall have the same meaning as it has in the eighth section of the Sanitary Act, 1868: provided always, that in any town where the sewer authority have not the power to make any such local rate, the said term shall include a rate which such sewer authority is hereby authorised to assess and levy, and which rate shall be assessed upon and levied from the persons and in the manner and with the like remedies in case of default in payment as if the same were a general yearly assessment made by commissioners acting in the execution of the principal act under the authority of section sixty of the said act.

Application to Ireland of the Sanitary Act, 1868, and the Sanitary Loans Act, 1869.

Penalties under any provisions incorporated with the Sanitary Act, 1868, shall be recovered and applied in like manner as penalties under the Sanitary Act, 1866.

All powers relating to the execution of the said acts in England, and by the same vested in one of her Majesty's Principal Secretaries of State, shall, with regard to the execution of the said acts in Ireland, be vested in the Lord Lieutenant.^a

PART III.

MISCELLANEOUS.

b 31. For the purpose of carrying this act into execution it shall be lawful for the Lord Lieutenant, with the approval of the Commissioners of her Majesty's Treasury, to appoint such persons at such salaries as he may think necessary, and from time to time to dismiss such persons and appoint others in their place. The persons so appointed shall act in the execution of this act and form the Local Government Department of the Chief Secretary's Office; and the salaries of such persons shall be paid out of moneys to be provided by Parliament for that purpose.

Lord Lieutenant, with approval of Treasury, to appoint persons to carry Act into execution.

32. Notwithstanding anything in this act contained, no provision of the same shall be held to extend or to be applicable to any town within the county of Dublin wherein the governing body have been constituted and are now acting under the provisions of any special act, unless and until such sanction, consent, and approval shall have been given to the adoption of such provision by a special resolution of the persons qualified to vote at any election of the members of the governing body of such town, to be passed at a meeting summoned as hereinafter mentioned.

Exception of towns in the county of Dublin under special Acts, unless with consent.

Meetings for the purpose of passing any special resolution within the meaning of the preceding paragraph in any town shall be summoned on the requisition in writing of not less than thirty persons qualified to vote at any election of members of the governing body of such

^a Now vested instead in Local Government Board, *vide* Local Government Board Act, 35 & 36 Vict., c. 60, and 37 and 38 Vict., c. 93.

^b Repealed by 35 and 36 Vict., c. 69, s. 12.

town by the chairman of such governing body, and a month's previous notice of the summoning of such meeting, stating the time and place where same is to be held, shall be given in some one or more newspaper or newspapers circulating within such town, and by causing copies of the same to be affixed to the principal doors of the places to which notices by such governing body are usually affixed.

The towns affected by the act are—(1.) The city of Dublin; (2.) Towns corporate; (3.) Towns having Commissioners appointed by virtue of an act made in the 9th year of the reign of George the Fourth, intituled "An Act to make provision for the Lighting, Cleansing, and Watching of Cities and Towns Corporate and Market Towns in Ireland in certain cases;" (4.) Towns under 3 & 4 Viet., c. 108; (5.) Towns under 17 & 18 Viet., c. 103; (6.) Towns and townships having commissioners under local acts.

EXTRACTS FROM THE LOCAL GOVERNMENT ACT, 1858,
AMENDMENT ACT, 1861.

24 and 25 VIC., CAP. 61.

[*Passed 1st August, 1861.*]

Local Board
may exercise
powers of sec.
45 of 11 & 12
Vic., c. 63, also
without their
district, if
necessary, for
the purposes
of outfall or
distribution
of sewage, on
making com-
pensation.

4. Local Boards may exercise the powers given by the forty-fifth section of "The Public Health Act, 1848,"^a also without their district, for the purpose of outfall or distribution of sewage, upon making due compensation, to be settled in the manner provided in the one hundred and forty-fourth section of "The Public Health Act, 1848:" provided always, that nothing herein contained shall give or be construed to give power to any local board to construct or use any outfall, drain, or sewer for the purpose of conveying sewage or filthy water into any natural watercourse or stream until such sewage or filthy or refuse water be freed from all excrementitious or other foul or noxious matter, such as would affect or deteriorate the purity and quality of the water in such stream or watercourse.

20. In districts where no water companies are established by act of parliament, all local boards ^b may make agreements for the supply of water to persons on such terms as may be agreed upon between the local board and the persons receiving such supply, and shall have the same powers for recovering water rents accruing under such agreements as they have for the recovery of water rates by the law in force for the time being.

^a In Ireland the Sewer Authority. See Sanitary Act, 1866, sec. 11, page 353.

THE DISEASES PREVENTION ACT, 1855.

18 & 19 VICTORIA, CAP. 116.

An Act for the better Prevention of Diseases.^a

[14th August, 1855].

[In the application of these Acts to Ireland, the changes prescribed by the 62nd sec. of the Sanitary Act, 1866, are to be observed.]

Whereas the provisions of "The Nuisances Removal and Diseases Prevention Act, 1848," amended by "The Nuisances Removal and Diseases Prevention Amendment Act, 1849," in so far as the same relate to the prevention or mitigation of epidemic, endemic, or contagious diseases, are defective, and it is expedient to substitute other provisions more effectual in that behalf: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. This act may be cited for all purposes as the "Diseases Prevention Act, 1855."

Short title.

[Sections 2 and 3, which define the local authority for executing the act, and provide for the expenses incurred, are repealed by section 10 of Act 23 and 24 Viet., c. 77.]

4. The local authority and their officers shall have power of entry for the purposes of this act, and for executing or superintending the execution of the regulations and directions of the general board issued under this act.

Power of entry,

5. Whenever any part of England appears to be threatened with or is affected by any formidable epidemic, endemic, or contagious disease, the Lords and others of her Majesty's most honourable Privy Council, or any three or more of them (the Lord President of the Council or one of her Majesty's principal Secretaries of State being one), may, by order or orders to be by them from time to time made, direct that the provisions herein contained for the prevention of diseases be put in force in England or in such parts thereof as in such order or orders respectively may be expressed, and may from time to time, as to all or any of the parts to which any such order or orders extend, and in like manner, revoke or renew any such order; and, subject to revocation and renewal as aforesaid, every such order shall be in force for six calendar months, or for such shorter period as in such order shall be expressed; and every such order of her Majesty's Privy Council, or of any members thereof, as aforesaid, shall be certified under the hand of the clerk in ordinary of her Majesty's Privy Council, and shall be published in the *London Gazette*; ^b and such publication shall be conclusive evidence of such order, to all intents and purposes.

Power to Privy Council to issue orders that provisions herein contained for prevention of diseases may be put in force.

6. From time to time after the issuing of any such order as aforesaid, and whilst the same continues in force, the General Board of Health ^c may issue directions and regulations as the said board think fit—

Power to General Board of Health to issue regulations to carry out such provisions.

^a This Act is amended by the Act of 1860.

^b In Ireland the *Dublin Gazette*.

^c In Ireland the Local Government Board now.

For the speedy interment of the dead.

For house to house visitation.

For the dispensing of medicines, guarding against the spread of disease, and affording to persons afflicted by or threatened with such epidemic, endemic, or contagious diseases such medical aid and such accommodation as may be required.

Local extent and duration of regulations of General Board.

And from time to time, in like manner, may revoke, renew, and alter any such directions and regulations as to the said board appears expedient, to extend to all parts in which the provisions of this act for the prevention of disease shall for the time being be put in force under such orders as aforesaid, unless such directions and regulations be expressly confined to some of such parts, and then to such parts as therein are specified; and (subject to the power of revocation and alteration herein contained) such directions and regulations shall continue in force so long as the said provisions of this act shall under such order be applicable to the same parts.

Publication of such Regulations.

7. Every such direction and regulation as aforesaid, when issued, shall be published in the *London Gazette*, and the Gazette in which such direction or regulation was published shall be conclusive evidence of the direction or regulation so published, to all intents and purposes.

The Local Authority to see to the execution of such Regulations, &c.

8. The local authority shall superintend and see to the execution of such directions and regulations, and shall appoint and pay such medical or other officer or persons, and do and provide all such acts, matters, and things as may be necessary for mitigating such disease, or for superintending or aiding in the execution of such directions and regulations, or for executing the same, as the case may require.

and may direct prosecutions for violating the same

9. The local authority may from time to time direct any prosecutions or legal proceedings for or in respect of the wilful violation or neglect of any such direction and regulation.

Orders of Council, Directions, and Regulations to be laid before Parliament. Order in Council may extend to parts and arms of the sea.

10. Every order of her Majesty's Privy Council, and every direction and regulation of the General Board of Health, under this act, shall be laid before both Houses of Parliament, forthwith upon the issuing thereof, if Parliament be then sitting, and if not, then within fourteen days next after the commencement of the then next session of Parliament.

11. Orders in Council issued in pursuance of this act for putting in force the provisions for the prevention of disease in the said Nuisances Removal and Diseases Prevention Acts contained, in *Great Britain* may extend to parts and arms of the sea lying within the jurisdiction of the Admiralty, and the Board of Health for *England* may issue under this act directions and regulations for cleansing, purifying, ventilating, and disinfecting, and providing medical aid and accommodation, and preventing disease in ships and vessels, as well upon arms and parts of the sea aforesaid as upon inland waters.

Medical Officer of Unions and others entitled to costs of attending sick on board vessels, when required by orders of General Board of Health.

12. Whenever, in compliance with any regulation of the General Board of Health, which they may be empowered to make under this act, any medical officer appointed under and by virtue of the laws for the time being for the relief of the poor shall perform any medical service on board of any vessel, such medical officer shall be entitled to charge extra for any such service, at the general rate of his allowance for his services for the union or place for which he is appointed, and such charges shall be payable by the captain of the vessel, on behalf of the owners, together with any reasonable expenses for the treatment of the sick; and if such services shall be rendered by any medical practitioner who is not a union or parish officer, he shall be entitled to charges for any service rendered on board, with extra remuneration on account of distance, at the same rate as those which he is in the habit of receiving from private patients of the class of those attended and treated on shipboard, to be paid as aforesaid; and in case of dispute in respect of such charges, such dispute may, where the charges do not exceed

twenty pounds, be determined summarily, at the place where the dispute arises, as in case of seamen's wages not exceeding fifty pounds, according to the provisions of the law in that behalf for the time being in force; and any justice before whom complaint is made shall determine summarily as to the amount which is reasonable according to the accustomed rate of charge within the place for attendance on patients of the like class or condition as those in respect of whom the charge is made.

13. The directions and regulations of the General Board of Health under this enactment shall be under the seal of the said board, and the hand of the president or two or more members thereof; and any copy of such regulations purporting to bear such seal and signature, whether the said signature and seal be respectively impressed and written or printed only, shall be evidence in all proceedings in which such regulations may come in question.

Authentication
of Directions
and Regula-
tions of
General Board
of Health.

14. Whoever wilfully obstructs any person acting under the authority or employed in the execution of this act, and whosoever wilfully violates any direction or regulation issued by the General Board of Health as aforesaid, shall be liable for every such offence to a penalty not exceeding five pounds, to be appropriated in or towards the defraying the expenses of executing this act.

Penalty for
obstructing
execution of
Act.

15. The provisions of any general act in force for the removal of nuisances, with regard to the service of notices, the proof of orders or resolutions of the local authority, and the recovery of penalties, shall extend and apply to this act.

Certain provi-
sions of Nuisances
Removal Act to
apply to this
Act.

THE NUISANCES REMOVAL AND DISEASES PREVENTION (AMENDMENT) ACT, 1860.

23 & 24 VICTORIA, CAP. 77.

An Act to Amend the Acts for the Removal of Nuisances and the Prevention of Diseases.^a

[6th August, 1860.]

Whereas the provisions of the Nuisances Removal Act for *England*, 1855, and the Diseases Prevention Act, 1855, concerning the local authority for the execution of the said acts, are defective, and it is expedient that the said acts should be amended as hereinafter mentioned: Be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

18 & 19 Vict.,
c. 121 & 116.

Nuisances Removal.

1. Section three, section six, section seven, and section nine of the said Nuisances Removal Act for *England*, 1855, shall be repealed: provided always that such repeal as aforesaid shall not extend to any charges or expenses already incurred, but the same may be defrayed and recovered, and all proceedings commenced or taken under the said act, and not yet completed, may be proceeded with, and all

Sections 3, 6, 7,
and 9 of 18 & 19
Vict., c. 121,
repealed.

^a In the application of this act to Ireland, the changes prescribed by Sec. 62 of the Sanitary Act, 1866, must be observed. See page 366.

contracts under the said act shall continue and be as effectual as if this act had not been passed.

[The more recent Public Health and Sanitary Acts deal with the subject.]

Board of
Guardians
may appoint
Committees
for particular
places.

5. Provided that the board of guardians for a union may appoint a committee or committees of their own body, under section five of the said Nuisances Removal Acts, to act in and for one or more of the parishes or places for which the board is the (Nuisance) Authority; and every committee so appointed shall have the full power of executing the said act in all respects, within the specified place or places for which it is appointed, unless its power be expressly limited by the terms of its appointment; and the board of guardians shall cause the charges and expenses of every such committee to be paid out of the poor rates of the place or places for which such committee is appointed; and where a committee is so appointed for any such place or places, the charges and expenses of the board as (Nuisance) Authority for or in respect of the place or places for which a committee is not appointed shall be paid or contributed by such last-mentioned place or places in like manner as the expenses of a committee: provided that where any one such committee is appointed for all the places for which the board is the (Nuisance) Authority, its charges and expenses shall be contributed and paid in like manner as the charges and expenses of the board would have been contributed and paid if such committee had not been appointed.

[Section 6 is not applicable to Ireland.]

Wells, &c.,
belonging to
any place
vested in
Local Authority, &c.

7. All wells, fountains, and pumps provided under section fifty of "The Public Health Act, 1848," or otherwise, for the use of the inhabitants of any place, and not being the property of or vested in any person or corporation other than officers of such place, shall be vested in the (Nuisance) Authority under this act for such place, who shall from time to time cause to be kept in good repair and condition and free from pollution all wells, fountains, and pumps vested in them under this act, and may also keep in good repair and condition and free from pollution other wells, fountains, and pumps dedicated to or open to the use of the inhabitants of such place.

[See "Public Health Act, 1874, sec. 42."]

Penalty for
fouling water

8. If any person do any act whatsoever whereby any fountain or pump is wilfully or maliciously damaged, or the water of any well, fountain, or pump is polluted or fouled, he shall, upon summary conviction of such offence before two justices, forfeit a sum not exceeding five pounds for such offence, and a further sum not exceeding twenty shillings for every day during which such offence is continued after written notice from the (Nuisance) Authority in relation thereto; but nothing herein contained shall extend to any offence provided against by section twenty-three of the said "Nuisances Removal Act."

Appointment
of Inspectors of
Nuisances.

9. Local authorities under this act may, for the purposes of the act, severally appoint or employ inspectors of nuisances, and make such payments as they see fit for the remuneration and expenses of such inspectors.

[A form of appointment, similar to the following, should be filled up, and given him to the person so appointed as his authority to act; and similar authority should be given to act as sanitary sub-officer, and also as acting clerk, so as to enable him to serve notices.]

ADDRESS AND DATE.

WE, the [Committee of the] Sanitary Authority of the _____ of
pursuant to our powers in that behalf, do HEREBY *appoint*
and employ

as an INSPECTOR OF NUISANCES for the

*Chairman of the Committee of the
said Nuisance Authority.*

[URBAN OR RURAL.]

RESOLVED :

That *pursuant* to the powers enabling the [Committee of the]
Sanitary Authority of the _____ in that behalf,

WE, the said Authority [or Committee], do HEREBY authorize

And he is hereby authorized to appear on behalf of the said Nuisance Authority generally, before any Justice or Justices, and in any legal proceedings which may be instituted against the said Nuisance Authority, and to institute and carry on any proceedings which the Nuisance Authority is authorized to institute and carry on under the Nuisance Removal Act or the Sanitary Acts, 1866, and Acts incorporated therewith, and the Public Health Act (Ireland), 1874.

*Chairman of [the Committee of] the
said Sanitary Authority.*

10. Sections two and three of "The Diseases Prevention Act, 1855," and every other enactment constituting a local authority for the execution of the same act, or providing for the expenses of the execution thereof, except those contained in the eighteenth and nineteenth of *Victoria*, chapter one hundred and twenty, the Metropolis Local Management Act, shall be repealed.

Secs. 2 & 3 of
18 & 19 Vict.,
c. 116, repealed.

11. The board of guardians for every union, or parish not within a union, in England shall be the local authority for executing the said Diseases Prevention Act in every place within their respective unions and parishes, and in every parish or place in England not within a union, and for which there is no board of guardians, the overseers of the poor shall be the local authority to execute the same act; and the expenses incurred in the execution of such act by the board of guardians for a union shall be defrayed out of the common fund thereof, and the expenses of the board of guardians or overseers

Guardians
and overseers
of the poor
to be the
Local Authorities
for executing
Diseases
Prevention Act.

a is made applicable to Ireland by the Sanitary Act, 1866, Sec. 62.

of the poor of any single parish or place shall be defrayed out of the rates for the relief of the poor of such parish or place: provided that every such board of guardians shall, for the execution of the said act for the prevention of diseases, have the like powers of appointing committees, with the like authority, and where any such committee is appointed the expenses thereof and of the board shall be paid in the same manner as hereinbefore provided where such a board is the local authority for the execution of the said Nuisances Removal Act: provided also, that any expenses already incurred by any Local Authority in the execution of the said act shall be defrayed as if this act had not been passed: provided, moreover, that in respect of any place where, under this act, the local authority for executing the Nuisances Removal Act is any other body than the board of guardians or the overseers of the poor, the Privy Council, if it see fit, may, in the manner provided for the exercise of its powers under the Public Health Act, 1858, authorise such other body to be, instead of the board of guardians or the overseers of the poor, the local authority for executing the Diseases Prevention Act: provided also, that as regards the metropolis the vestries and district boards under the act of the session holden in the eighteenth and nineteenth years of her Majesty, chapter one hundred and twenty, within their respective parishes and districts, shall continue to be the local authorities for the execution of the "Diseases Prevention Act, 1855," and their charges and expenses shall be defrayed as if this act had not been passed.

Local Authorities may provide carriages for conveyance of infected persons.

12. It shall be lawful for the local authority for executing the said "Diseases Prevention Act" to provide and maintain a carriage or carriages suitable for the conveyance of persons suffering under any contagious or infectious disease, and to convey such sick and diseased persons as may be residing within such locality to any hospital or other place of destination, and the expense thereof shall be deemed to be an expense incurred in executing the said act.

Justices, on the application of householders, may order the removal of nuisances.

13. Upon complaint before a justice of the peace by any inhabitant of any parish or place of the existence of any nuisance on any private premises in the same parish or place, such justice shall issue a summons requiring the person by whose act, default, permission, or sufferance the nuisance arises, or if such person cannot be found or ascertained, the owner or occupier of the premises on which the nuisance arises, to appear before two justices in petty sessions assembled at their usual place of meeting, who shall proceed to inquire into the said complaint, and act in relation thereto as in cases where complaint is made by a (Nuisance) Authority under section twelve of the said Nuisances Removal Act, and as if the person making the complaint were such (Nuisance) Authority: provided always, that it shall be lawful for the said justices, if they see fit, to adjourn the hearing or further hearing of such summons for an examination of the premises where the nuisance is alleged to exist, and to require the admission or authorise the entry into such premises of any constable or other person or persons, and thereupon the person or persons authorised by the order of the justices may enter and act as the local authority might under a like order made by any justice under section eleven of the said act: provided also, that the costs in the case of every such application shall be in the discretion of the justices, and payment thereof may be ordered and enforced as in other cases of summary adjudication by justices. Any order made by justices under this enactment shall be attended with the like penalties and consequences for disobedience thereof and subject to the like appeal as any order made under section twelve of the said Nuisances Removal Act, and the justices making such order may thereby authorise any constable or other person or persons to do all acts for removing or abating the nuisance condemned or prohibited, and for executing such order, in like manner as a local authority obtaining the like order might do

under the said act, and to charge the costs to the person on whom the order is made, as is provided in the case where a like order is obtained and executed by such local authority.

14. The guardians of any union, or parish not within a union, may at any time employ one of their medical officers to make inquiry and report upon the sanitary state of their union or parish, or any part thereof, and pay a reasonable compensation for the same out of their common fund. Guardians may procure sanitary reports and pay for the same.

15. The several words used in this act shall be construed in the same manner as is declared with reference to the same words in the above cited act, termed "The Nuisances Removal Act for *England*, 1855," and all the provisions therein, and in "The Diseases Prevention Act, 1855," contained, shall respectively be applicable to this act, except so far as they shall be hereby repealed, or be inconsistent with anything herein provided. Interpretation of terms.

16. *a* No justice of the peace shall, unless objected to at the hearing of any complaint or charge, be deemed incapable of acting in cases other than appeals arising under the said Nuisances Removal Act by reason of his being a member of any body hereby declared to be the local authority to execute the said act, or by reason of his being a contributor, or liable to contribute, to any rate or fund out of which it is here provided that all charges and expenses incurred in executing the said act, and not recovered as therein provided, shall be defrayed. Justices not incapable of acting by being members of bodies to execute Nuisances Removal Act.

NUISANCES REMOVAL ACT (1855) AMENDMENT, 1863.

26 & 27 VICTORIA, CAP. 117.

An Act to amend the Nuisances Removal Act for *England*, 1855, with respect to the seizure of diseased and unwholesome meat.

[28th July, 1863.]

Whereas the provisions of "The Nuisances Removal Act for *England*, 1855," with regard to the inspection and seizure of diseased and unwholesome meat, are defective, and it is therefore expedient that

a This section (16) has been amended by 29 and 30 Vict., c. 41, Sec. 2, as follows :—
"No Justice of the Peace shall be deemed incapable of acting in cases under the Nuisances Removal Act, or the Act of the 23 and 24 Vict., c. 79 or 177, by reason of his being a member of any body thereby declared to be the authority to execute the said act, or by reason of his being a contributor or liable to contribute to any rate or fund out of which it is thereby provided that all charges and expenses incurred in executing the said act, and not recovered as therein provided, shall be defrayed."

The following is the Justices of the Peace Act, 1867 (30 and 31 Vict., c. 115):—
"A Justice of the Peace shall not be incapable of acting as a Justice at any Petty, or Special, or General, or Quarter Sessions, on the trial of an offence arising under an act to be put in execution by a Municipal Corporation, or a Local Board of Health, or Improvement Commissioners, or Trustees, by reason only of his being as one of the several ratepayers, or as one of any other class of persons liable in common with the others to contribute to, or to be benefited by, any fund to the account of which the penalty payable in respect of such offence is directed to be carried, or of which it will form part, or to contribute to any rate or expenses in diminution of which such penalty will go." It has been held that Justices being *ex-officio* members of a Board of Guardians were competent to try cases under the Adulteration of Food Acts in which the Boards of Guardians were prosecutors.

the same should be repealed, and that other and more effectual provisions in that behalf should be substituted therefor: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Sec. 26 of
recited Act
repealed.
Power to
Medical Officer of
Health or
Inspector of
Nuisances to
inspect any
animal, &c.

1. From and after the passing of this act, the twenty-sixth section of the said act is repealed.

2. *a* The medical officer of health or inspector of nuisances may at all reasonable times inspect and examine any animal, carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour, exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and intended for the food of man; the proof, that the same was not exposed or deposited for such purpose or purposes, or was not intended for the food of man, resting with the party charged; and in case any such animal, carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour *b* appear to him to be diseased, or unsound, or unwholesome, or unfit for the food of man, it shall be lawful for such Medical Officer of Health or Inspector of Nuisances to seize, take, and carry away the same, or direct the same to be seized, taken, and carried away by any officer, servant, or assistant, in order to have the same dealt with by a justice; and if it shall appear to the justice that any such animal, or any of the said articles, is diseased, or unsound or unwholesome, or unfit for the food of man, he shall order the same to be destroyed, or so disposed of as to prevent such animal or articles from being exposed for sale or used for such food; and the person to whom such animal, carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour belongs or did belong at the time of sale or of exposure for sale, or in whose possession or on whose premises the same is found, shall, upon conviction, be liable to a penalty not exceeding twenty pounds for every animal, carcass, or fish, or piece of meat, flesh, or fish, or any poultry or game, or for the parcel of fruit, vegetables, corn, bread, or flour, so found, or, at the discretion of the justice, without the infliction of a fine, to imprisonment in the common gaol or house of correction for a term of not more than three calendar months.

Penalty for
obstructing
Medical
Officer of
Health, &c.

3. In case any person shall in any manner prevent such medical officer of health or inspector of nuisances from entering any slaughter-house, shop, building, market, or other place where such animal, carcass, meat, poultry, or fish is kept for the purpose of sale or of preparation for sale, or shall in any manner obstruct or impede him, or his servant or assistant, when duly engaged in carrying the provisions of this act into execution, such person shall be liable to a penalty not exceeding five pounds.

This and recited
Act to be as one
Act.
Short title.

4. This act and "The Nuisances Removal Act for *England*, 1855," shall be read and construed together as one act.

5. This act may be cited for all purposes as "The Nuisances Removal Act for *England* (Amendment) Act, 1863."

a The case of *Webb v. Daly* was the first prosecution under this act as extended to Ireland by the Act, 32 and 33 Vict., cap. 108. The defendant, who was a foreman butcher, residing in Dublin, was summoned by the officer of the authority for being the owner of, or possessed of, a quantity of diseased, unsound, or unwholesome meat, which was deposited in a certain cart or place for the purpose of sale or of preparation for sale, and intended for the food of man. A case was stated to the Queen's Bench by the magistrate, at the request of the defendant, who submitted that a cart was not a "place" within the meaning of the act. The Queen's Bench, however, upheld the conviction, upon the ground that a cart upon which meat is placed for the preparation for sale is such a place as is within the meaning of sec. 2; and although said meat was not in the immediate possession of said owner, and although it was not exposed for sale, it was held that the ownership being proved, the owner was liable. The evidence of the owner was held to be inadmissible.—*Webb v. Daly*, 3, 1. L. T., 180.

b Also milk, see 37 and 38 Vict., c. 23, sec. 56, page 347.

EXTRACTS FROM THE PUBLIC HEALTH ACT, 1848.

11 & 12 VICT., CAP. 63.

90. And be it enacted, that whenever the Local Board of Health have incurred or become liable to any expenses which by this act are or by the said local board shall be declared to be private improvement expenses, the said local board may, if they shall think fit, make and levy upon the occupier of the premises in respect of which the expenses shall have been incurred, except in the cases hereinafter provided, in addition to all other rates, a rate or rates to be called private improvement rates, of such amount as will be sufficient to discharge such expenses, together with interest thereon at a rate not exceeding five pounds in the hundred, in such period not exceeding thirty years as the said local board shall in each case determine: provided always, that whenever any premises in respect of which any private improvement rate is made become unoccupied before the expiration of the period for which the rate was made, or before the same is fully paid off, such rate shall become a charge upon and be paid by the owner of the premises so long as the same continue to be unoccupied.

Private Improvement Rates.

91. And be it enacted, that if the occupier by whom any private improvement rate is paid holds the premises in respect of which the rate is made at a rent not less than the rackrent, he shall be entitled to deduct three-fourths of the amount paid by him on account of such rate from the rent payable by him to his landlord, and if he holds at a rent less than the rackrent he shall be entitled to deduct from the rent so payable by him such proportion of three-fourths of the rate as his rent bears to the rackrent; and if the landlord from whose rent any deduction is made under the provision last aforesaid is himself liable to the payment of rent for the premises in respect of which the deduction is made, and holds the same for a term of which less than twenty years is unexpired, but not otherwise, he may deduct from the rent so payable by him such proportion of the sum deducted from the rent payable to him as the rent payable by him bears to the rent payable to him, and so in succession with respect to every landlord (holding for a term of which less than twenty years is unexpired) of the same premises both receiving and liable to pay rent in respect thereof: provided always, that nothing herein contained shall be construed to entitle any person to deduct from the rent payable by him more than the whole sum deducted from the rent payable to him.

Proportion of Private Improvement Rate may be deducted from Rent.

92. Provided always, and be it enacted, that at any time before the expiration of the period for which any special district rate or private improvement rate is made, the owner or occupier of the premises assessed thereto may redeem the same, by paying to the local board of health the expenses in respect of which the rate was made, or such parts thereof as may not have been defrayed by sums already levied in respect of the same.

Redemption of special District and Private Improvement Rates.

ARBITRATION.

123. And be it enacted, that in case of dispute as to the amount of any compensation to be made under the provisions of this act (except where the mode of determining the same is specially provided for), and in case of any matter which by this act is authorized or directed to be settled by arbitration, then, unless both parties concur in the appointment of a single arbitrator, each party, on the request of the other, shall appoint an arbitrator, to whom the matter shall be referred; and every such appointment when made on the behalf of the local board of health shall (in the case of a non-corporate district) be under their seal and the hands of any five or more of their number, or under the common seal in case of a corporate district, and on the behalf of any other party under his hand, or if such party be a corporation aggregate, under the common seal thereof; and such appoint-

Mode of referring to arbitration.

ment shall be delivered to the arbitrators, and shall be deemed a submission to arbitration by the parties making the same ; and after the making of any such appointment, the same shall not be revoked without the consent of both parties, nor shall the death of either party operate as a revocation ; and if for the space of fourteen days after any such matter shall have arisen, and notice in writing by one party who has himself duly appointed an arbitrator to the other party, stating the matter to be referred, and accompanied by a copy of such appointment, the party to whom notice is given fail to appoint an arbitrator, the arbitrator appointed by the party giving the notice shall be deemed to be appointed by and shall act on behalf of both parties : and the award of any arbitrator or arbitrators appointed in pursuance of this act shall be binding, final, and conclusive upon all persons, and to all intents and purposes whatsoever.

[A local board of health having under sec. 45 of the 11 & 12 Vict., c. 63, made a sewer through the land of A, he claimed compensation for the damage done thereby under sec. 144 (sec. 8 of the Sewage Utilization Act, 1865, page 79, is identical with sec. 144 of this act), and proceeded to appoint an arbitrator. The local board of health declined to appoint an arbitrator, on the ground that A had not sustained any damage, because his property was benefited by the making of the sewer, and the arbitrator of A made his award *ex parte* : Held that this was a case in which the amount of drainage was disputed, and not a case in which the liability to make any compensation was denied, and therefore the award was valid.—In re *Bradley*, 4 El. & Bl. 1014, 1 Jur. N. S. 778, 24 L. J. Q. B. 239.]

A *mandamus* to a local board of health reciting that the prosecutor has sustained damage by reason of the acts of the board in the exercise of the powers of this act, that he had demanded compensation according to the provisions of this act, and that the board had denied all liability, commanded the board to make compensation out of the general or special rate to be levied under this act. Return : that the board had not denied all liability, and was willing to make such compensation as soon as it should be duly ascertained ; that such compensation had not yet been ascertained, nor had the prosecutor taken any steps towards having it ascertained, nor given notice of the cause or amount of his claim for compensation, nor informed the board whether it had exceeded £20, nor given notice of his intention to appoint an arbitrator. The return being traversed, the jury found that the board had denied their liability, but that the prosecutor had made no claim for any specific sum : Held (affirming the judgment of the Queen's Bench, 29 L. J. Q. B. 21), first, that under sec. 144 (which section is in substance the 8th section of Sewage Utilization Act, 1865) the proper course was to ascertain the liability of the board in the first instance, and therefore the *mandamus* was good. Secondly, that it was not necessary that the prosecutor should claim any specific amount of compensation.—*Reg. v. Burslem Board of Health*, 6 Jur., N. S. 696.

Williams J.—*Prima Facie*, inasmuch as *mandamus* is the proper remedy to compel the performance of a public duty, this is a proper case for a *mandamus*.—*Ib.* I am indebted to Mr. J. O. Byrne's excellent book on Irish Sanitary Laws for most of the reports of cases given in this work.]

124. And be it enacted, that if before the determination of any matter so referred any arbitrator die, or refuse, or become incapable to act, the party by whom such arbitrator was appointed may appoint in writing another person in his stead ; and if he fail so to do for the space of seven days after notice in writing from the other party in that behalf, the remaining arbitrator may proceed *ex parte* ; and every arbitrator so appointed shall have the same powers and authorities as were vested in the arbitrator in whose stead the appointment is made ; and in case a single arbitrator die, or become incapable to act, before the making

Death, &c., of
one of several
arbitrators.

of single
arbitrator.

of his award, or fail to make his award within twenty-one days after his appointment, or within such extended time, if any, as shall have been duly appointed by him for that purpose, the matters referred to him shall be again referred to arbitration under the provisions of this act, as if no former reference had been made.

125. And be it enacted, that in case there be more than one arbitrator, the arbitrators shall, before they enter upon the reference, appoint by writing under their hands an umpire, and if the person appointed to be umpire die, or become incapable to act, the arbitrators shall forthwith appoint another person in his stead; and in case the arbitrators neglect or refuse to appoint an umpire for seven days after being requested so to do by any party to the arbitration, the court of general or quarter sessions shall, on the application of any such party, appoint an umpire; and the award of the umpire shall be binding, final, and conclusive upon all persons and to all intents and purposes whatsoever; and in case the arbitrators fail to make their award within twenty-one days after the day on which the last of them was appointed, or within such extended time, if any, as shall have been duly appointed by them for that purpose, the matters referred shall be determined by the umpire; and the provisions of this act with respect to the time for making an award, and with respect to extending the same in the case of a single arbitrator, shall apply to an umpirage.

Appointment of umpire by the parties.

by Quarter Sessions.

[Under this section, arbitrators who have failed to make their award within twenty-one days after the day upon which the last of them was appointed may nevertheless after the expiration of that period appoint an umpire.—*Holdsworth v. Barsham*, 10 W. R., 646; 8 Jur. N. S., 672. Arbitrators may appoint an umpire after the twenty-one days, limited by sec. 125 for making their award, have expired without their having enlarged the time, provided such appointment be within the time limited by sec. 126 for making the umpirage.—*Holdsworth v. Wilson*, 32 L. J. Q. B. 289; 11 W. R. 733; 8 L. T. N. S. 434, Ex. Cham.]

This section places an umpire, with respect to the time for making his award, in the same position as a single arbitrator; and by sec. 124, a single arbitrator is required to make his award within twenty-one days after his appointment, or within such extended time as shall have been appointed by him.—*Killett v. Board of Health of Tranmere*, 13 W. R. 207; 11 L. T. N. S. 457.

When an umpire, without extending the time for making his award, made his award after the twenty-one days from the time when he was appointed by the arbitrator had elapsed: held that the award was bad.—*Ib.*

An umpire did not extend the time, nor did he make his award within twenty-one days, but he appointed a day for the reference when both the parties attended; but the Board of Health, by their clerk, protested against the proceedings. The umpire, however, proceeded with the reference. Both the claimant and the local board went into their cases, examined witnesses, and addressed the umpire: held that the local board was not by its conduct before the umpire in going into the case, and examining witnesses, and addressing the umpire, estopped from afterwards disputing the umpire's jurisdiction.—*Ringland v. Lowndes*, 10 Jur. N. S. 850; 33 S. J. C. P. 337.]

126. Provided always, and be it enacted, that the time for making an award under this act shall not be extended beyond the period of three months from the date of the submission or from the day on which the umpire shall have been appointed (as the case may be).

Time within which award must be made.

127. And be it enacted, that any arbitrator, arbitrators, or umpire appointed by virtue of this act may require the production of such documents in the possession or power of either party as they or he may think necessary for determining the matters referred, and may examine the parties or their witnesses on oath; and the costs of and consequent upon the reference shall be in the discretion of the arbi-

Power to Arbitrator to require production of documents.

Submission
may be made
a rule of
court.

Declaration
to be made
by arbitrator
and umpire.

trator or arbitrators, or of the umpire (in case the matters referred are determined by an umpire under the power hereinbefore contained in that behalf); and any submission to arbitration under the provisions of this act may be made a rule of any of the superior courts, on the application of any party thereto.

128. And be it enacted, that before any arbitrator or umpire shall enter upon any such reference as aforesaid he shall make and subscribe the following declaration before a justice of the peace (that is to say),

"I, *A. B.*, do solemnly and sincerely declare that I will faithfully and honestly, and to the best of my skill and ability, hear and determine the matters referred to me under the Public Health Act, 1848.

"*A. B.*"

And such declaration shall be annexed to the award when made; and if any arbitrator or umpire shall wilfully act contrary to such declaration he shall be guilty of a misdemeanour.

NUISANCES REMOVAL AND DISEASES PREVENTION ACTS CONSOLIDATION AND AMENDMENT ACT.

The Nuisances Removal Act for England, 1855.

18 & 19 VICTORIA, CAP. 121.

An Act to consolidate and amend the Nuisances Removal and Diseases Prevention Acts, 1848 and 1849. *a*

[14th August, 1855.]

11 and 12 Vict., c. 123., Whereas the provisions of "The Nuisances Removal and Diseases Prevention Act, 1848," amended by "The Nuisances Removal and Diseases Prevention Amendment Act, 1849," are defective, and it is expedient to repeal the said acts as far as relates to *England*, and to substitute other provisions more effectual in that behalf: be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present parliament assembled, and by the authority of the same, as follows:

Recited Acts repealed as far as relates to England, except as to proceedings commenced.

1. From and after the passing of this act the said acts are by this section repealed as far as relates to *England*: *b* provided always, that all proceedings commenced or taken under the said acts, and not yet completed, may be proceeded with under the said acts; and all contracts or works undertaken by virtue of the said acts shall continue and be as effectual as if the said acts had not been repealed.

a This act, as amended by the Nuisance Removal and Disease Prevention Amendment Act, 1860, is extended to Ireland by the 62nd section of the Sanitary Act, 1866, the changes prescribed by the section being, of course, observed.

b These acts have been repealed as to Ireland by the Sanitary Act, 1866, sec. 69.

2. In this act the following words and expressions have the meanings by this section hereinafter assigned to them, unless such meanings be repugnant to or inconsistent with the context; (that is to say,) the word "*place*"^a includes any city, borough, district under the Public Health Act, parish, township, or hamlet, or part of any such city, borough, district, town, parish, township, or hamlet; the word "*guardians*" includes the directors, wardens, overseers, governors, or other like officers having the management of the poor for any parish or place where the matter or any part of the matter requiring the cognizance of any such officer arises; the word "*borough*," and the expressions "*mayor, aldermen, and burgesses*," "*council*," and "*borough fund*," have respectively the same meaning as in the acts for the regulation of municipal corporations, and shall also respectively mean, include, and apply to any royal borough, royal town, or other town having a warden, high bailiff, borough reeve, or other chief officer, and burgesses or inhabitants, however designated, associated with him in the government or management thereof, or any town or place having a governing body therein in the nature of a corporation or otherwise, and to the chief officers and governing bodies of such boroughs, towns, and places, and to the funds and property under the management of or at the disposal of such chief officers and governing bodies; the expression "*improvement act*" means an act for regulating and managing the police of, and for draining, cleansing, paving, lighting, watching, and improving a place, and an act for any of those purposes; the word "*owner*" includes any person receiving the rents of the property in respect of which that word is used from the occupier of such property on his own account, or as trustee or agent for any other person, or as receiver or sequestrator appointed by the Court of Chancery or under any order thereof, or who would receive the same if such property were let to a tenant; the word "*premises*" extends to all messuages, lands, or tenements, whether open or enclosed, whether built on or not, and whether public or private; the word "*parish*" includes every township or place separately maintaining its poor or separately maintaining its own highways; the expression "*quarter sessions*" means the court of general or quarter sessions of the peace for a county, riding, or division of a county, city, or borough; the word "*person*" and words applying to any person or individual apply to and include corporations, whether aggregate or sole; and the expression "*two justices*" shall, in addition to its ordinary signification, mean one stipendiary or police magistrate acting in any police court for the district.

Interpretation
of certain terms
used in this
Act.

[The operative words in this section are "means," "includes," "extends," and "apply to." The effect of the word "means" is to limit the interpretation. The effect of all the other words is to enlarge it.—*Reg. v. Kershaw*, 2 El. & Bl., 1007.]

Section 3, which defined the local authority, related only to England, and has been repealed by the Act 23 & 24 Vict., c. 77, s. 1.

Section 4 relates exclusively to England. For Ireland see 57th sec. of Sanitary Act, 1866.]

PART I.

Constitution of Nuisance Authority, Expenses, Description of Nuisances, and Powers of Entry.

And with respect to the constitution of the Nuisance Authority for

^a "Place."—A temporary wooden structure without a roof, and used on a race-course for the purpose of betting, is a place.—*Kelly*, C.B. It does not seem to me to

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the execution of this act, the expenses of its execution, the description of nuisances that may be dealt with under it, and the powers of entry for the purposes of the act, be it enacted thus :

Power to
(Nuisance)
Authority to
appoint
Committees.

5. The Nuisance Authority may appoint any committee of their own body to receive notices, take proceedings, and in all or certain specified respects execute this act, whereof two shall be a quorum; and such Nuisance Authority, or their committee, may, in each particular case, by order in writing under the hand of the chairman of such body or committee, empower any officer or person to make complaints and take proceedings on their behalf.

[For appointment of Officers of Health, see Public Health Act, Ireland, 1874, sec. 10.]

Sections 6 and 7 are repealed by the Act of 1860, 23 and 24 Vict., c. 77, sec. 1.]

What are
deemed
nuisances under
this Act.

8. The word "nuisance" under this act shall include—

Any premises in such a state as to be a nuisance or injurious to health :

Any pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit so foul as to be a nuisance or injurious to health :

Any animal so kept as to be a nuisance or injurious to health :
Any accumulation or deposit which is a nuisance or injurious to health :

Provided always, that no such accumulation or deposit as shall be necessary for the effectual carrying on of any business or manufacture shall be punishable as a nuisance under this section, when it is proved to the satisfaction of the justices that the accumulation or deposit has not been kept longer than is necessary for the purposes of such business or manufacture, and that the best available means have been taken for protecting the public from injury to health thereby. ^a

[Sec. 9 is repealed by the Act of 1860.]

Notice of
nuisance to be
given to
[Nuisance]
Authority, &c.,
to ground
Proceedings.

10. ^b Notice of nuisance may be given to the Nuisance Authority by any person aggrieved thereby, or by any of the following persons: the sanitary inspector or any paid officer under the said Nuisance Authority; two or more inhabitant householders of the parish or place to which the notice relates; the relieving officer of the union or parish; any constable or any officer of the constabulary or police force of the district or place; and in case the premises be a common lodging house, any person appointed for the inspection of common lodging houses; and the Nuisance Authority may take cognizance of any such nuisance after entry made as hereinafter provided, or in conformity with any improvement act under which the inspector has been appointed.

11. The Nuisance Authority shall have power of entry for the following purposes of this act, and under the following conditions:—

Power of
Entry to
(Nuisance)
Authority or
their officer.

(1.) To ground proceedings.

For this purpose, when they or any of their officers have reasonable grounds for believing that a nuisance exists on any private premises, demand may be made by them or their officer, on any person having custody of the premises, of admission to inspect the same at any hour between nine in the morning and six in the evening, and if admission be not granted any justice having jurisdiction in the place may, on oath made before him of belief in the existence of the nuisance, and after reasonable notice of the intended application to such justice

matter whether this structure had a roof or not, or whether it was fastened by some means or other into the earth or not; it was a structure in which the business of betting could be and was conducted, and in my opinion clearly came within the meaning of the words "office or place," as used in the act.—*Shaw v. Morley*, 37 L. J. N. S. M. C. 105.

^a The word "nuisance" has been further defined in sec. 19 of the Sanitary Act, 1866, page 13.

^b See schedule, page 395, for form of notice.

being given in writing to the party on whose premises the nuisance is believed to exist, by order under his hand require the person having the custody of the premises to admit the Nuisance Authority or their officer; and if no person having custody of the premises can be discovered, any such justice may and shall, on oath made before him of belief in the existence of such nuisance, and of the fact that no person having custody of the premises can be discovered, by order under his hand authorise the Nuisance Authority or their officers to enter the premises between the hours aforesaid.

- (2.) To examine premises where nuisances exist, to ascertain the course of drains, and to execute or inspect works ordered by justices to be done under this act.

For these purposes, whenever, under the provisions of this act, a nuisance has been ascertained to exist, or when an order of abatement or prohibition under this act has been made, or when it becomes necessary to ascertain the course of a drain, the Nuisance Authority may enter on the premises, by themselves or their officers, between the hours aforesaid, until the nuisance shall have been abated, or the course of the drain shall have been ascertained, or the works ordered to be done shall have been completed, as the case may be.

- (3.) To remove or abate a nuisance in case of non-compliance with or infringement of the order of justices, or to inspect or examine any carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour,^a under the powers and for the purposes of this act.

For this purpose the Nuisance Authority or their officer may from time to time enter the premises where the nuisance exists, or the carcass, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour is found, at all reasonable hours, or at all hours during which business is carried on on such premises, without notice. *b*

PART II.

With regard to the removal of nuisances, be it enacted thus :—

12. In any case where a nuisance is so ascertained by the (Nuisance) Authority to exist, or where the nuisance in their opinion did exist at the time when the notice was given, and, although the same may have been since removed or discontinued, it is in their opinion likely to recur or to be repeated on the same premises or any part thereof, they shall cause complaint thereof to be made before a justice of the peace; and such justice shall thereupon issue a summons, requiring the person by whose act, default, permission, or sufferance the nuisance arises or continues, or if such person cannot be found or ascertained, the owner or occupier of the premises on which the nuisance arises, to appear before any two justices in petty sessions assembled, at the usual place of meeting, who shall proceed to inquire into the said complaint; and if it be proved to their satisfaction that the nuisance exists, or did exist at the time when the notice was given, or if removed or discontinued since the notice was given, that it is likely to recur or to be repeated, the justices shall make an order in writing under their hands and seals on such person, owner, or occupier for the abatement or discontinuance and prohibition of the nuisance as hereinafter mentioned, and shall also make an order for the payment of all calls incurred up to the time of hearing or making the order for abatement or discontinuance or prohibition of the nuisance.

Proceedings
by (Nuisance)
Authority before
Justices in
the case of
Nuisances
likely to
recur, &c.

If proved to
Justices that
Nuisance
exists, &c., they
shall issue order
for abatement,
&c.

^a And milk. See 37 and 38 Vict., c. 93, s. 56.

^b See 37 and 38 Vict., c. 9, s. 57.

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[The following is the form of notice in use in Dublin before the passing of the Public Health Act, 1874 :—

BOROUGH OF DUBLIN.

To _____
of No. _____

NOTICE.

and to the Owner or Occupier.

Under 29 & 30 Vict., Cap. 90.

The Lord Mayor, Aldermen, and Burgesses, being the Sanitary Authority of this Borough, having ascertained that a nuisance exists in or upon the house or premises at _____ that is to say

so as to be a nuisance or injurious to health, and that such nuisance exists by reason of your acts, default, or sufferance.

Now, take notice, that you are hereby required to remove or abate the same, and for that purpose to do all such things as may be necessary within _____ days, otherwise proceedings will be taken against you by the said Nuisance Authority without further notice, under the provisions of the Sanitary Act, 1866, 29 and 30 Vict., cap. 90, and the several acts incorporated therewith for the abatement and removal of such nuisance, and to enforce the provisions of said acts against you, and for the recovery of the penalties thereby imposed, in the event of your refusal or neglect to comply with the terms of this notice.

Dated this _____ day of _____

18

Signed, _____

Clerk or Acting Clerk of the said Nuisance Authority]

[If sanitary sub-officers be empowered to serve notices for the abatement of nuisances, without in the first instance reporting to the sanitary authority, they can only legally do so by being first appointed acting clerks to the local authority. See the 62nd section of the Public Health (Ireland) Act, 1874. It would also be desirable to appoint the sub-sanitary officers to be inspectors of nuisances under the provisions of the Sanitary Act, 1866.]

Justices' order for abatement.

13. By their order the justices may require the person on whom it is made to provide sufficient privy accommodation, means of drainage or ventilation, or to make safe and habitable, or to pave, cleanse, whitewash, disinfect, or purify the premises which are a nuisance or injurious to health, or such part thereof as the justices may direct in their order, or to drain, empty, cleanse, fill up, amend, or remove the injurious pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit which is a nuisance and injurious to health, or to provide a substitute for that complained of, or to carry away the accumulation or deposit which is a nuisance or injurious to health, or to provide for the cleanly and wholesome keeping of the animal kept so as to be a nuisance or injurious to health, or if it be proved to the justices to be impossible so to provide, then to remove the animal, or any or all of these things (according to the nature of the nuisance), or to do such other works or acts as are necessary to abate the nuisance complained of, in such manner and within such time as in such order shall be specified; and if the justices are of opinion that such or the like nuisance is likely to recur, the justices may further prohibit the recurrence of it, and direct the works necessary to prevent such recurrence, as the case may in the judgment of such justices require; and if the nuisance proved to exist be such as to render a house or building, in the judgment of the justices, unfit for human habitation, they may prohibit the using thereof for that purpose until it is rendered fit for that purpose in the judgment of the justices, and on their being satisfied that it has been rendered fit for such purpose they may determine their previous order by another declaring such house habitable, from the date of which other order such house may be let or inhabited.

Prohibitive order against future Nuisance.

Penalty for contravention of order of abatement and of prohibition.

14. Any person not obeying the said order for abatement shall, if he fail to satisfy the justices that he has used all due diligence to carry out such order, be liable for every such offence to a penalty of not more

than ten shillings per day during his default; and any person knowingly and wilfully acting contrary to the said order of prohibition shall be liable for every such offence to a penalty not exceeding twenty shillings per day during such contrary action; the (Nuisance) Authority may, under the powers of entry given by this act, enter the premises to which the order relates, and remove or abate the nuisance condemned or prohibited, and do whatever may be necessary in execution of such order, and charge the cost to the person on whom the order is made, as hereinafter provided.

15. Any such order of prohibition may be appealed against as provided in this act.

16. When it shall appear to the justices that the execution of structural works is required for the abatement of a nuisance, they may direct such works to be carried out under the direction or with the consent or approval of any public board, trustees, or commissioners having jurisdiction in the place in respect of such works, and if within seven days from the date of the order the person on whom it is made shall have given notice to the Nuisance Authority of his intention to appeal against it, as provided in this act, and shall have entered into recognisances to try such appeal as provided by this act, and shall appeal accordingly, no liability to penalty shall arise, nor shall any work be done nor proceedings taken under such order until after the determination of such appeal, unless such appeal cease to be prosecuted.

17. Whenever it appears to the satisfaction of the justices that the person by whose act or default the nuisance arises, or the owner or occupier of the premises, is not known or cannot be found, then such order may be addressed to and executed by such (Nuisance) Authority, and the cost defrayed out of the rates or funds applicable to the execution of this Act.

18. Any matter or thing removed by the (Nuisance) Authority in pursuance of this enactment may be sold by public auction, after not less than five days' notice by posting bills distributed in the locality, unless in cases where the delay would be prejudicial to health, when the justices may direct the immediate removal, destruction, or sale of the matter or thing; and the money arising from the sale retained by the (Nuisance) Authority, and applied in payment of all expenses incurred under this act with reference to such nuisance, and the surplus, if any, shall be paid on demand by the (Nuisance) Authority to the owner of such matter or thing.

19. All reasonable costs and expenses from time to time incurred in making a complaint, or giving notice, or in obtaining an order of justices under this act, or in carrying the same into effect under this act, shall be deemed to be money paid for the use and at the request of the person on whom the order is made, or if the order be made on the (Nuisance) Authority, or if no order be made, but the nuisance be proved to have existed when the complaint was made or the notice given, then of the person by whose act or default the nuisance was caused; and in case of nuisances caused by the act or default of the owner of premises, the said premises shall be and continue chargeable with such costs and expenses, and also with the amount of any penalties incurred under this act, until the same be fully discharged: provided that such costs and expenses shall not exceed in the whole one year's rackrent of the premises; and such costs and expenses, and penalties, together with the charges of suing for the same, may be recovered in any county or superior court, or if the (Nuisance) Authority think fit, before any two justices of the peace; and the said justices shall have power to divide such costs, expenses, and penalties between the persons by whose act or default the nuisance arises, in such manner as they shall consider reasonable; and if it appear to them that a complaint made under this act is frivolous or

(Nuisance) Authority may enter and remove or abate Nuisance.

Appeal against order of prohibition. Appeal against order of abatement when structural works are required.

If person causing Nuisance cannot be found, (Nuisance) Authority to execute order at once. Manure, &c., to be sold.

Costs and expenses of works to be paid by person on whom order is made, or owner or occupier

Proceedings
before Justices
to recover
expenses.

unfounded, they may order the payment by the (Nuisance) Authority or person making the complaint of the costs incurred by the person against whom the complaint is made, or any part thereof.

20. Where any costs, expenses, or penalties are due under or in consequence of any order of justices made in pursuance of this act as aforesaid, any justice of the peace, upon the application of the (Nuisance) Authority, shall issue a summons, requiring the person from whom they are due to appear before two justices at a time and place to be named therein; and upon proof to the satisfaction of the justices present that any such costs, expenses, or penalties are so due, such justices, unless they think fit to excuse the party summoned upon the ground of poverty or other special circumstances, shall, by order in writing under their hands and seals, order him to pay the amount to the (Nuisance) Authority at once, or by such instalments as the justices think fit, together with the charges attending such application, and the proceedings thereon; and if the amount of such order, or any instalment thereof, be not paid within fourteen days after the sum is due, the same may, by warrant of the said or other justices, be levied by distress and sale.

Surveyors of
highways to
cleanse
ditches, &c.,
paying
owners, &c., for
damages.

21. All surveyors and district surveyors may make, scour, cleanse, and keep open all ditches, gutters, drains, or watercourses, in and through any lands or grounds adjoining or lying near to any highway, upon paying the owner or occupier of such lands or grounds, provided they are not waste or common, for the damages which he shall thereby sustain, to be settled and paid in such manner as the damages for getting materials in enclosed lands or grounds are directed to be settled and paid by the law in force for the time being with regard to highways.

Power to
(Nuisance)
Authority to
cover and
improve
open ditches,
&c.

22. Whenever any ditch, gutter, drain, or watercourse used or partly used for the conveyance of any water, filth, sewage, or other matter from any house, buildings, or premises is a nuisance within the meaning of this act, and cannot, in the opinion of the (Nuisance) Authority, be rendered innocuous without the laying down of a sewer or of some other structure along the same or part thereof or instead thereof, such (Nuisance) Authority shall and they are hereby required to lay down such sewer or other structure, and to keep the same in good and serviceable repair, and they are hereby declared to have the same powers as to entering lands for the purposes thereof, and to be entitled to recover the same penalties in case of interference, as are contained in the sixty-seventh and sixty-eighth sections of the act passed in the fifth and sixth years of the reign of King William the Fourth, intituled *An Act for Consolidating and Amending the Laws relating to Highways in England*; and such (Nuisance) Authority are hereby authorized and empowered to assess every house, building, or premises then or at any time thereafter using for the purposes aforesaid the said ditch, gutter, drain, watercourse, sewer, or other structure, to such payment, either immediate or annual, or distributed over a term of years, as they shall think just and reasonable, and, after fourteen days' notice at the least left on the premises so assessed, to levy and collect the sum and sums so assessed in the same manner, and with the same remedies in case of default in payment thereof, as highway rates are by the law in force for the time being leviable and collectable, and with the same right and power of appeal against the amount of such assessments reserved to the person or persons so assessed as by the law for the time being in force shall be given against any rate made for the repair of the highways; and the provisions contained in this section shall be deemed to be part of the law relating to highways in *England*: provided always, that where such ditch, gutter, drain, or watercourse shall, as to parts thereof, be within the jurisdiction of different (Nuisance) Authorities, this enactment shall apply to each (Nuisance) authority only as to so much of the works hereby required, and the expenses thereof, as is included within the respective juris-

diction of that authority: provided also, that such assessment shall in no case exceed a shilling in the pound on the assessment to the highway rate, if any.

23. Any person or company engaged in the manufacture of gas who shall at any time cause or suffer to be brought or to flow into any stream, reservoir, or aqueduct, pond, or place for water, or into any drain communicating therewith, any washing or other substance produced in making or supplying gas, or shall wilfully do any act connected with the making or supplying of gas whereby the water in any such stream, reservoir, aqueduct, pond, or place for water shall be fouled, shall forfeit for every such offence the sum of two hundred pounds.

Penalty for causing water to be corrupted by gas washings.

24. Such penalty may be recovered, with full costs of suit, in any of the superior courts, by the person into whose water such washing or other substance shall be conveyed or shall flow, or whose water shall be fouled by any such act as aforesaid; or if there be no such person, or in default of proceedings by such person, after notice to him from the (Nuisance) Authority of their intention to proceed for such penalty, by the Nuisance Authority; but such penalty shall not be recoverable unless it be sued for during the continuance of the offence, or within six months after it shall have ceased.

Penalty to be sued for in Superior Courts within six months.

25. In addition to the said penalty of two hundred pounds (and whether such penalty shall have been recovered or not), the person or company so offending shall forfeit the sum of twenty pounds (to be recovered in the like manner) for each day during which such washing or other substance shall be brought or shall flow as aforesaid, or during which the act by which such water shall be fouled shall continue, after the expiration of twenty-four hours from the time when notice of the offence shall have been served on such person or company by the (Nuisance) Authority, or the person into whose water such washing or other substance shall be brought or flow, or whose water shall be fouled thereby, and such penalty shall be paid to the parties from whom such notice shall proceed; and all moneys recovered by a (Nuisance) Authority under this or the preceding section shall, after payment of any damage caused by the act for which the penalty is imposed, be applied towards defraying the expenses of executing this act.

Daily penalty during the continuance of the offence.

27. If any candle house, melting house, melting place, or soap-house, or any slaughter-house, or any building or place for boiling offal or blood, or for boiling, burning, or crushing bones, or any manufactory, building, or place used for any trade, business, process, or manufacture causing effluvia, be at any time certified to the (Nuisance) Authority by any medical officer, or any two legally qualified medical practitioners, to be a nuisance or injurious to the health of the inhabitants of the neighbourhood, the (Nuisance) Authority shall direct complaint to be made before any justice, who may summon before any two justices in petty sessions assembled at their usual place of meeting the person by or in whose behalf the work so complained of is carried on, and such justices shall inquire into such complaint; and if it shall appear to such justices that the trade or business carried on by the person complained against is a nuisance, or causes any effluvia injurious to the health of the inhabitants of the neighbourhood, and that such person shall not have used the best practicable means for abating such nuisance or preventing or counteracting such effluvia, the person so offending (being the owner or occupier of the premises, or being a foreman or other person employed by such owner or occupier), shall, upon a summary conviction for such offence, forfeit and pay a sum of not more than five pounds nor less than forty shillings, and upon a second conviction for such offence the sum of ten pounds, and for each subsequent conviction a sum double the amount of the penalty imposed for the last preceding conviction, but the highest amount of such

As to nuisances arising in cases of noxious trades, businesses, processes, or manufactures:

penalty shall not in any case exceed the sum of two hundred pounds: provided always, that the justices may suspend their final determination in any such case, upon condition that the person so complained against shall undertake to adopt, within a reasonable time, such means as the said justices shall judge to be practicable and order to be carried into effect for abating such nuisance, or mitigating or preventing the injurious effects of such effluvia, or shall give notice of appeal in the manner provided by this act, and shall enter into recognizances to try such appeal, and shall appeal accordingly: provided always, that the provisions hereinbefore contained shall not extend or be applicable to any place without the limits of any city, town, or populous district.

Reference to
Superior
Court at the
option of the
party com-
plained against.

28. Provided also, that if, upon his appearance before such justices, the party complained against object to have the matter determined by such justices, and enter into recognizances, with sufficient sureties to be approved by the justices, to abide the event of any proceedings at law or in equity that may be had against him on account of the subject matter of complaint, the local authority shall thereupon abandon all proceedings before the justices, and shall forthwith take proceedings at law or in equity in her Majesty's superior courts for preventing or abating the nuisance complained of.

On certificate
of Medical
Officer to
(Nuisance)
Authority that
House is
over-crowded,
proceedings
may be taken
to abate the
same.

29. Whenever the medical officer of health, if there be one, or, if none, whenever two qualified medical practitioners shall certify to the (Nuisance) Authority that any house is so overcrowded as to be dangerous or prejudicial to the health of the inhabitants, and the inhabitants shall consist of more than one family, the (Nuisance) Authority shall cause proceedings to be taken before the justices to abate such overcrowding, and the justices shall thereupon make such order as they may think fit, and the person permitting such overcrowding shall forfeit a sum not exceeding forty shillings.

[The overcrowding of dwellings under any circumstances is declared to be a nuisance under section 19 of the Sanitary Act, 1866.]

(Nuisance)
Authority
to order costs
of prosecutions
to be paid
out of the
rates.

30. The (Nuisance) Authority may, within the area of their jurisdiction, direct any proceedings to be taken at law or in equity in cases coming within the purview of this act, and may order proceedings to be taken for the recovery of any penalties, and for the punishment of any persons offending against the provisions of this act, or in relation to appeals under this act, and may order the expenses of all such proceedings to be paid out of the rates or funds administered by them under this Act.

PART III.

As to Procedure under this Act.

And with regard to procedure under this act, be it enacted, That

Service of
notices,
summonses,
and orders.

31. Notices, summonses, and orders under this Act may be served by delivering the same to or at the residence of the persons to whom they are respectively addressed, and where addressed to the owner or occupier of premises they may also be served by delivering the same or a true copy thereof to some person upon the premises, or if there be no person upon the premises who can be so served, by fixing the same upon some conspicuous part of the premises, or if the person shall reside at a distance of more than five miles from the office of the inspector, then by a registered letter through the post.

Proof of resolu-
tions of
(Nuisance)
Authority.

32. Copies of any orders or resolutions of the (Nuisance) Authority or their committee, purporting to be signed by the chairman of such body or committee, shall, unless the contrary be shown, be received as evidence thereof, without proof of their meeting, or of the official character or signature of the person signing the same.

33. Where proceedings under this Act are to be taken against several persons in respect of one nuisance caused by the joint act or default of such persons, it shall be lawful for the (Nuisance) Authority to include such persons in one complaint, and for the justices to include such persons in one summons; and any order made in such a case may be made upon all or any number of the persons included in the summons, and the costs may be distributed as to the justices may appear fair and reasonable.

As to proceedings taken against several persons for the same offence.

34. In case of any demand or complaint under this act to which two or more persons, being owners or occupiers of premises, or partly the one or partly the other, may be answerable jointly or in common or severally, it shall be sufficient to proceed against any one or more of them without proceeding against the others or other of them; but nothing herein contained shall prevent the parties so proceeded against from recovering contribution in any case in which they would now be entitled to contribution by law.

One or more joint owners or occupiers may be proceeded against alone.

35. Whenever in any proceeding under this act, whether written or otherwise, it shall become necessary to mention or refer to the owner or occupier of any premises, it shall be sufficient to designate him as the "owner" or "occupier" of such premises, without name or further description.

Designation of "Owner" or "Occupier."

36. Whoever refuses to obey an order of justices under this act for admission on premises of the (Nuisance) Authority or their officers, or wilfully obstructs any person acting under the authority or employed in the execution of this act, shall be liable for every such offence to a penalty not exceeding five pounds.

Penalty for obstructing execution of this Act.

37. If the occupier of any premises prevent the owner thereof from obeying or carrying into effect the provisions of this act, any justice to whom application is made in this behalf shall, by order in writing, require such occupier to desist from such prevention or to permit the execution of the works required to be executed: provided that such works appear to such justice to be necessary for the purpose of obeying or carrying into effect the provisions of this act; and if within twenty-four hours after the service of such order the occupier against whom it is made do not comply therewith he shall be liable to a penalty not exceeding five pounds for every day afterwards during the continuance of such non-compliance.

Penalty on occupier obstructing owner.

38. Penalties imposed by this act for offences committed, and sums of money ordered to be paid under this act, may be recovered by persons thereto competent in *England*, according to the provisions of the act of the eleventh and twelfth years of the present reign, chapter forty-three; and all penalties recovered by the (Nuisance) Authority under this act shall be paid to them, to be by them applied in aid of their expenses under this act. *a*

Penalties and expenses recoverable under 11 and 12 Vict., c. 43.

39. No order, nor any other proceeding, matter, or thing done or transacted in or relating to the execution of this act shall be vacated, quashed, or set aside for want of form; nor shall any order, nor any other proceeding, matter, or thing done or transacted in relation to the execution of this act, be removed or removable by *certiorari* or by any other writ or process whatsoever into any of the superior courts; and proceedings under this act against several persons included in one complaint shall not abate by reason of the death of any among the persons so included, but all such proceedings may be carried on as if the deceased person had not been originally so included.

Proceedings not to be quashed for want of form.

40. Appeals under this act shall be to the Court of Quarter Sessions held next after the making of the order appealed against; but the appellant shall not be heard in support of the appeal unless within

Appeals under this Act to be to Quarter Sessions.

a In Ireland penalties are to be proceeded for in the manner prescribed by the Petty Sessions (Ireland) Act, 1851; see also sec. 64, Public Health Act, 1874.

fourteen days after the making of the order appealed against he give to the (Nuisance) Authority notice in writing stating his intention to bring such appeal, together with a statement in writing of the grounds of appeal, and shall within two days of giving such notice enter into a recognizance before some justice of the peace, with sufficient securities, conditioned to try such appeal at the said court, and to abide the order of and pay such costs as shall be awarded by the justices at such court or any adjournment thereof; and the said court, upon hearing and finally determining the matter of the appeal, may, according to its discretion, award such costs to the party appealing or appealed against as they shall think proper, and its determination in or concerning the premises shall be conclusive and binding on all persons to all intents or purposes whatsoever: provided always, that if there be not time to give such notice and enter into such recognizance as aforesaid, then such appeal may be made to, and such notice, statement, and recognizance be given and entered into for, the next sessions at which the appeal can be heard: provided also, that on the hearing of the appeal no grounds of appeal shall be gone into or entertained other than those set forth in such statement as aforesaid: provided also, that in any case of appeal the Court of Quarter Sessions may, if they think fit, state the facts specially for the determination of her Majesty's Court of Queen's Bench, in which case it shall be lawful to remove the proceedings, by writ of *certiorari* or otherwise, into the said Court of Queen's Bench.

Forms to be used as in Schedule.

41. The forms contained in the schedule to this act annexed, or any forms to the like effect, varied as circumstances may require, may be used for instruments under this act, and shall be sufficient for the purpose intended.

As to protection of (Nuisance) Authority and its officers.

42. The (Nuisance) Authority, and any officer or person acting under the authority and in execution or intended execution of this act, shall be entitled to such protection and privilege in actions and suits and such exemption from personal liability as are granted to local boards of health and their officers by the law in force for the time being.

Act not to impair Jurisdiction of Sewers Commissioners or Common Law Remedies for Nuisance, nor Jurisdiction of (Nuisance) Authority, as to the Nuisances referred to in this Act.

43. Nothing in this act shall be construed to affect the provisions of any local act as to matters included in this act, nor to impair, abridge, or take away any power, jurisdiction, or authority which may at any time be vested in any commissioners of sewers or of drainage, or to take away or interfere with any course of proceedings which might be resorted to or adopted by such commissioners if this act had not passed, nor to impair any power of abating nuisances at common law, nor any jurisdiction in respect of nuisances that may be possessed by any authority under the act intituled *An Act to abate the Nuisances arising from the Smoke of Furnaces in the Metropolis, and from Steam Vessels above London Bridge*, or the Common Lodging Houses Acts, the Act for the Regulation of Municipal Corporations, the Public Health Act, or any improvement act respectively, or any acts incorporated with such acts, and authorities may respectively proceed for the abatement of nuisances or in respect of any other matter or thing hereinbefore provided or referred to either under the acts mentioned in this section or any other act conferring jurisdiction in respect of the nuisances referred to in this act, or any bye-laws framed under any such act, as they may think fit; and the local authorities constituted under and for the purposes of the Common Lodging Houses Act, 1851 and 1853, shall for the purpose of those acts have all the powers of (Nuisance) Authorities under this act.

Act not to affect navigation of rivers or canals.

44. Nothing herein contained shall enable any (Nuisance) Authority, surveyor of highways, or other person, either with or without any order of justices, to injuriously affect the navigation of any river or canal, or to divert or diminish any supply of water of right belonging to any such river or canal; and the provisions of this act shall not

extend or be construed to extend to mines of different descriptions, so as to interfere with or obstruct the efficient working of the same, or to the smelting of ores and minerals, or to the manufacturing of the produce of such ores and minerals.

45. No power given by this act shall be exercised in such manner as to injuriously affect the supply, quality, or fall of water contained in any reservoir or stream, or any feeders of such reservoir or stream, belonging to or supplying any waterwork established by Act of Parliament, or in cases where any company or individual are entitled for their own benefit to the use of such reservoir or stream, or to the supply of water contained in such feeders, without the consent in writing of the company or corporation in whom such waterworks may be vested, or of the parties so entitled to the use of such reservoirs, streams, and feeders, and also of the owners thereof in cases where the owners and parties so entitled are not the same person.

Saving as to
rights of mill
owners, &c.

46. In citing this act in other Acts of Parliament, and in legal instruments and other proceedings, it shall be sufficient to use the words "The Nuisances Removal Act for *England*, 1855."

SCHEDULE OF FORMS.

FORM (A).

Order of Justices for Admission of Officer of (Nuisance) Authority to inspect private Premises.

Whereas [describe the (Nuisance) Authority] have by their officer [naming him] made application to me, A. B., one of her Majesty's Justices of the Peace having jurisdiction in and for [describe the place], and the said officer has made oath to me of his belief that a nuisance, within the meaning of the Nuisances Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, viz. [describe nuisance], exists on private premises at [describe situation of premises so as to identify them], within my jurisdiction, and demand of admission to such premises for the inspection thereof has been duly made under the said act, and refused :

Now, therefore, I, the said A. B., do hereby require you to admit the said [name the (Nuisance) Authority], [or the officer of the said (Nuisance) Authority], for the purpose of inspecting the said premises.

Dated this day of , 18 .

A. B.

FORM (B).

Notice of Nuisance.

To the (Nuisance) Authority (*describing it*).

I [or we], the person aggrieved by the nuisance hereinafter described [or the undersigned and described inhabitant householders, sanitary inspector] [or other officer (describing him,)] do hereby give you notice, that there exists in or upon the [dwelling-house, yard, &c., as the case may be], situate at [giving such description as may be sufficient to identify the premises] in the parish of _____ in your district

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under the Nuisances Removal Act, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, the following nuisance, videlicet [*describing the Nuisance, as the case may be ; for instance, a dwelling house or building, a nuisance or injurious to health or want of a privy, or drain, or sufficient means of ventilation, or so dilapidated or so filthy as to be a nuisance or injurious to health, or for further instance, a ditch or drain so foul as to be a nuisance or injurious to health, or an accumulation of a nuisance or injurious to health, &c., or swine so kept as to be a nuisance or injurious to health*], and that such nuisance is caused by [*naming the person by whose act or default the nuisance is caused, or by some person unknown*].

Dated this day of in the year of our Lord one thousand eight hundred and

[*Signed by complainant under section 10.*]

FORM (C).

Notice to Owner or Occupier of entry for Examination.

To the owner [*or occupier, as the case may be,*] of [*describe the premises*], situate at [*insert a description sufficient to identify the Premises*].

Take notice, that under the Nuisance Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, the [(*Nuisance*) *Authority, naming it*], in whose district under the said act the above premises are situate, have received a notice from [*name complainant*], stating that in or upon the said premises [*insert the cause of nuisance as set forth in the notice.*]

And further take notice, That after the expiration of twenty-four hours from the service of this notice the (*Nuisance*) *Authority* will cause the said premises to be entered and examined under the provisions of the said act, and if the cause of nuisance aforesaid be found still existing, or, though removed or discontinued, be likely to be repeated, a summons will be issued requiring your attendance to answer a complaint which will be made to the justices for enforcing the removal of the same, and prohibiting a repetition thereof, and for recovering the costs and penalties that may be incurred thereby.

Dated this day of in the year of our Lord one thousand eight hundred and

A. B.

The officer appointed by the (*Nuisance*) *Authority* to take proceedings under the Nuisance Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866.

FORM (D).

Summonses.

To the Owner or Occupier of [*describe Premises*], situate at [*insert such a description as may be sufficient to identify the premises*], or to A. B., of

County of
[or borough of,
&c., or district of,
or as the case may be]
to wit.

You are required to appear before two of her Majesty's justices of the peace [*or one of the magistrates of the police courts of the metropolis, or the stipendiary magistrate*] of the county [*or other jurisdiction*] of at the petty sessions [*or court*] holden at

on the day of next, at the hour of
 in the noon, to answer the complaint this day made to
 me by [or by on behalf of] *[naming the (Nuisance) Authority,
 as the case may be]*, that in or upon the premises above-mentioned [or
 in or upon certain premises situate at No. in the
 street, in the parish of or such other description or reference
as may be sufficient to identify the premises], in their district, under the
 Nuisances Removal Act for England, 1855, as amended and extended
 to Ireland by the Sanitary Act, 1866, the following nuisance exists
[describing it, as the case may be], and that the said nuisance is caused
 by the act or default of the occupier [or owner] of the said premises,
 or by you, *A. B.* [or in case the nuisance be discontinued, but likely to be
 repeated, say, there existed recently, to wit, on or about the
 day of on the premises the following nuisance *[describe
 the nuisance]*, and that the said nuisance was caused *[&c.]*, and al-
 though the same has since the said last-mentioned day been removed
 or discontinued, there is reasonable ground to consider that the same
 or the like nuisance is like to recur on the said premises.

Given under the hand of me, *J. P.*, Esquire, one of her Majesty's
 justices of the peace acting in and for the *[jurisdiction]* stated
 in the margin, or one of the magistrates of the police courts
 of the metropolis, or stipendiary magistrate of
 day of in the year of our Lord one thousand eight
 hundred and

FORM (E).

Order of Justices for Removal of Nuisances by Owner, &c.

To the Owner [or Occupier] of *[describe the Premises]*, situate *[give
 such description as may be sufficient to identify the Premises,] or
 to A. B. of or to [giving name of the (Nuisance)
 Authority]*, or to their servants or agents, and to all whom it
 may concern.

County of } Whereas on the day of
 [or borough, &c., of } complaint was made before
 or } Esquire, one of her Majesty's justices of the
 district of } peace acting in and for the county [or other
 or as the case may be.] } *[jurisdiction]* stated in the margin [or before
 the undersigned, one of the magistrates of
 the police courts of the metropolis, or as the
 case may be], by [or by
 on behalf of] the (Nuisance) Authority *[naming it as the case may be]*,
 that in or upon certain premises situate at in the
 district under the Nuisances Removal Act for England, 1855, as
 amended and extended to Ireland by the Sanitary Act, 1866, of the
 complainants above named, the following nuisance then existed
[describing it]; and that the said nuisance was caused by the act or
 default of the owner [or occupier] of the said premises [or was caused
 by *A. B.*] *(If the nuisance have been removed, say, the following
 nuisance existed on or about [the day the nuisance was ascertained to
 exist], and that the said nuisance was caused, &c., and although the
 same is now removed, the same or the like nuisance is likely to recur
 on the same premises.)*

And whereas the owner [or occupier] within the
 meaning of the said Nuisances Removal Act, 1855, as amended and
 extended to Ireland by the Sanitary Act, 1866 [or the said *A. B.*],

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hath this day appeared before us justiees, being two of her Majesty's justiees in and for _____, sitting in petty sessions at their usual place of meeting [*or before me, the said magistrate of the police courts of the metropolis, or as the case may be*], to answer the matter of the said complaint [*or in case the party charged do not appear, say*]. And whereas it hath been this day proved to our [*or my*] satisfaction that a true eopy of a summons requiring the owner [*or oecupier*] of the said premises [*or the said A. B.*] to appear this day before us [*or me*] _____ hath been duly served according to the said act.

Now upon proof here had before us [*or me*] that the nuisance so complained of doth exist on the said premises, and that the same is caused by the act or default of the owner [*or oecupier*] of the said premises [*or by the said A. B.*], we [*or I*], in pursuance of the said act, do order the said owner [*or oecupier, or A. B.*], within [*specify the time*] from the service of this order or a true eopy thereof according to the said act [*here specify the works to be done, as, for instance, to cleanse, white-wash, purify, and disinfect the said dwelling house; or for further instance, to construct a privy, or drain, &c.; or for further instance, to cleanse or to cover or to fill up the said cesspool, &c.*], so that the same shall no longer be a nuisance or injurious to health as aforesaid.

[*And if it appear to the justices that the nuisance is likely to recur on the premises, say, [and we, or I] being satisfied that, notwithstanding the said cause or causes of nuisances may be removed under this order, the same is or are likely to recur, do therefore prohibit the said owner [or oecupier or A. B.] from [here insert the matter of the prohibition, as, for instance, from using the said house or building for human habitation until the same, in our judgment, is rendered fit for that purpose.]*

And if the above order for abatement be not complied with [*or if the above order of prohibition be infringed*], then we [*or I*] do authorise and require you the said [(Nuisance) Authority, naming it] from time to time to enter upon the said premises, and to do all such works, matters, and things as may be necessary for carrying this order into full execution according to the act aforesaid.

In case the nuisance were removed before complaint, say, [Now upon proof here had before us, that at or recently before the time of making the said complaint, to wit, on _____ as aforesaid, the cause of nuisance complained of did exist on the said premises, but that the same hath since been removed, yet notwithstanding such removal, we, [or I] being satisfied that it is likely that the same or the like nuisance will recur on the said premises, do hereby prohibit, [order of prohibition]; and if this order of prohibition be infringed, then we [or I] [order on (Nuisance) Authority to do works.]

Given under the hands and seals of us, two of her Majesty's justices of the peace in and for _____ [*or the hand and seal of me, one of the magistrates of the police courts of the metropolis, or as the case may be*],
 this _____ day of _____
 in the year of our Lord one thousand eight hundred and _____

FORM (F).

Order of Justices for Removal of Nuisance by (Nuisance) Authority.

To the Town Council, &c., as the case may be.

County, &c., } Whereas [*recite complaint of nuisance as in last form*].
to wit.

And whereas it hath been now proved to our [or my] satisfaction that such nuisance exists, but that no owner or occupier of the premises, or person causing the nuisance, is known or can be found [*as the case may be*]: Now we [or I], in pursuance of the said act, do order the said [(Nuisance) Authority, naming it] forthwith to [*here specify the works to be done.*]

Given, &c.

FORM (G).

Order to permit execution of Works by Owners.

County of } Whereas complaint hath been made to me,
[or borough of } *E. F.*, Esquire, one of her Majesty's
or metropolitan police } justices of the peace in and for the county
district, or as the case } [or borough, &c.] of
may be], to wit. } [or one of the magistrates of the police
courts of the metropolis, or as the case may be, or one of her Majesty's
justices of the peace, as the case may be, of the county of

], by *A. B.*, owner within the meaning of the Nuisances Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, of certain premises, to wit, a dwelling house [or building, or as the case may be], situate at [*insert such a description of the premises as may be sufficient to identify them*], in the parish of in the said county [or borough, &c.], that *C. D.*, the occupier of the said premises, doth prevent the said *A. B.* from obeying and carrying into effect the provisions of the said act, in this, to wit, that he, the said *C. D.* [*here describe the act of prevention generally, according to the circumstances; for instance, thus*, doth refuse to quit the said house, the same having by the order of justices been declared unfit for human habitation, or doth prevent the said *A. B.* from cleansing or whitewashing or purifying the said dwelling house, or erecting a privy or drain, or breaking an aperture for ventilation, or cleansing a drain, ditch, gutter, watercourse, privy, urinal, cess-pool, or ashpit which is a nuisance or injurious to health]; and whereas the said *C. D.* has been summoned to answer the said complaint, and has not shown sufficient cause against the same, and it appears to me that [*describe the act or works to be done*] is necessary for the purpose of enabling the said *A. B.* to obey and carry into effect the provisions of the said act, I do hereby order that the said *C. D.* do permit the said *A. B.* [*describe the act or works to be done*] in the manner required by the said act.

Given under my hand and seal this

day of

thousand eight hundred and

in the year of our Lord one

E. F. (L.S.)

FORM (H).

Summons for Nonpayment of Costs, Expenses, or Penalties.

Section 20.

To

[Describe the Person from whom the Costs, and Penalties are due.]

County of *or* Bo-
rough of *or* District
of, to wit.

County of *or* Bo- You are required to appear before two of her
rough of *or* District Majesty's justices of the peace [*or* one of the
of, to wit. magistrates of the police courts of the metro
polis, *or* the stipendiary magistrates] of the
county [*or other jurisdiction*] of at the petty sessions [*or court*]
holden at on the day of next,
at the hour of in the noon, to answer the complaint
this day made to me by [*or by* on behalf of] *naming*
the (Nuisance) Authority], that the sum of pounds, being
costs and expenses incurred by you under and in relation to a certain
complaint touching [*describe the Nuisance*], and an order of [*describe*
the person making the order] duly made in pursuance of the Nuisances
Removal Act for England, 1855, as amended and extended to Ireland
by the Sanitary Act, 1866 [*if Penalties are due, add, and also the sum*
of being the amount of penalties payable by you
for disobedience of the said order], remains unpaid and due from you.

Given under the hand of me, *J.P.*, Esquire, one of her Majesty's
justices of the peace, acting in and for the [*jurisdiction stated in*
the margin] [*or one of the magistrates of the police courts of the*
metropolis, or stipendiary magistrate of]
the day of in the year of our

Lord one thousand eight hundred and

FORM (I) .

Order for Payment of Costs, Expenses, and Penalties.

Section 20.

To

[name the person on whom the Order is made].

County, &c.,
to wit.

County, &c., } Whereas complaint has been made before us
to wit. } [or me] for that [*recite cause of complaint* :
And whereas the said [*naming the person*
against whom the complaint is made] has this day appeared before us the
said justices [or before me the said magistrate of the police courts of
the metropolis, *or as the case may be*], to answer this matter of the said
complaint : [*Or, in case the party charged do not appear, say*],

And whereas it has been this day satisfactorily proved to us [or me] that a true copy of the summons requiring the said [naming person charged] to appear before us [or me] this day hath been duly served according to the said act: Now, having heard the matter of the said complaint, we [or I] do adjudge the said [naming the person charged] to pay forthwith [or by instalments of _____] payable respectively on or before the _____ to the said [naming the person or (Nuisance) Authority to whom the costs adjudged are payable], the sum of _____ for costs in this behalf, and to [naming the person or Authority to whom the expenses are payable] the sum of _____ for expenses in this behalf [if Penalties are due, add, and the sum of _____ for penalties incurred in relation to the premises], together with the sum of _____ being the charges attending the application for this order and proceedings thereon; and if the said several

sums, amounting in the whole to [or if any one of the said instalments] be not paid within fourteen days after the same is due as aforesaid, we [or I] hereby order that the same be levied by distress and sale of the goods and chattels of the said and in default of sufficient distress in that behalf adjudge the said

to be imprisoned in the common gaol [or house of correction, as the case may be], at in the said county [or as the case may be], for the space of such time, not exceeding three calendar months, as the justices may think fit, unless the said several sums [or sum], and all costs and charges of the said distress [and of the commitment and carrying of the said to the said house of correction or common gaol, or as the case may be], shall be sooner paid..

Given under our [or my] hands, this day of
in the year of our Lord one thousand eight hundred and
at in the [county, or as the case
may be], aforesaid.

FORM (K).

Warrant of Distress. Sec. 20:

To the constable of and to all other peace officers in the
said county [or as the case may be].

Whereas on last past complaint was made before the undersigned, two of her Majesty's justices of the peace in and for the said county of [or as the case may be] [or a magistrate of the police courts of the metropolis or stipendary magistrate, as the case may be] for that [Sec., as in the order]; and thereupon having considered the matter of the said complaint, we [or I] adjudged the said [set out from Form K the adjudication of payment and the order for distress and for imprisonment in default of distress]: and whereas the time in and by the said order appointed for the payment of the said several sums of and hath elapsed, but the said hath not paid the same or any part thereof within fourteen days after the date fixed by the order for such payment, but therein hath made default: These are therefore to command you in her Majesty's name forthwith to make distress of the goods and chattels of the said A. B., and if within the space of days after the making of such distress the said last-mentioned sums, together with the reasonable charges of taking and keeping the said distress, shall not be paid, that then you do sell the said goods and chattels so by you distrained, and do pay the money arising from such sale over to the clerk of the justices of the peace for the division of

in the said [County, or as the case may be], that he may pay and apply the same as by law directed, and may render the overplus, if any, on demand, to the said ; and if no such distress can be found, then that you certify the same unto me, to the end that such proceedings may be had therein as to the law doth appertain.

Given under our [or may] hands and seal, this

day of in the year of our Lord one thousand
eight hundred and at in
the [county] aforesaid.

A. B.
C. D.

[L.S.]

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FORM (L).

Return of proceedings under Nuisances Removal Act, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, by the [name the (Nuisance) Authority at length].

From 25th March, 1855, to 25th March, 1856.

Date of Notice.	By Whom given.	Nature of Nuisance.	Proceedings taken.	Remarks:—With any special Work done under the Acts without any Notice.
16 April	The Inspector.	Foul Drainage from House.	Owner put down good Drain, on Summons without Justices' Order.	Several Houses being in a like position, the Highway Surveyor laid down a Sewer in the old water-course, and each House was charged a proportionate sum for the same, of which the highest sum was 10s.
18 April	Two Neighbours.	Offensive Cesspool.	Abated by (Nuisance) Authority.	Renewed once; but penalty recovered, and no subsequent Renewal attempted.

Dated this 26th day of March, 1856. [*To be signed by the
Chairman of the (Nuisance) Authority.*]

THE SEWAGE UTILIZATION ACT.^a

28 AND 29 VICTORIA, CAP. 75.

An Act for facilitating the more useful Application of Sewage in
Great Britain and Ireland.

[29th June, 1865.]

Whereas it is expedient to remove difficulties under which Local Boards and other bodies having the care of sewers labour in disposing of the sewage of their districts so as not to be a nuisance, and to give facility to such authorities to make arrangements for the application of such sewage to land for agricultural purposes: Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same:

1. This act, for all purposes, may be cited as "The Sewage Short title.
Utilization Act, 1865." ^b

2. This act shall not extend to any part of the metropolis, as defined by the act of the Session Eighteenth and Nineteenth Years of the present Reign, chapter one hundred and twenty, for better Local Management of the metropolis, and shall not, with the exception of clause fifteen, extend to any parish as defined in the schedule to this act in a part of which parish the Public Health Act, 1848, and the Local Government Act, 1858, or one of such acts, is in force at the time of the passing of this act.

3. The expression "Sewer Authority" shall, in the several places in the schedule ^c annexed hereto in that behalf mentioned, mean the persons or bodies of persons referred to in the first column of the schedule annexed hereto; and the term "District," in relation to a Sewer Authority, shall, as respects each authority, mean the place in that behalf referred to in the second column of the said schedule.

4. "Local Board" shall mean a Local Board authorized in pursuance of the "Public Health Act, 1848," and the "Local Government Act, 1858," or one of such acts.

5. Sewer Authorities shall have power to construct such sewers as they may think necessary for keeping their district properly cleansed and drained, and shall, as respects all sewers constructed by them or under their control, whether the same were made before or after the passing of this act, have all the powers that Local Boards have, in respect of sewers vested in or constructed by them, under the forty-fifth and forty-sixth sections of "The Public Health Act, 1848," the thirtieth section of "The Local Government Act, 1858," and the fourth section of "The Local Government Act, 1858, Amendment Act, 1861," subject to the provisions of the fifth and sixth sections of the last mentioned act, and to the saving clauses in "The Local Government Act, 1858," mentioned, from sixty-eight to seventy-four, both inclusive; and in *Scotland*, in addition to such of the aforesaid powers as are applicable to *Scotland*, all the powers contained in section seven (Public Sewers) of part four of "The General Police and Improvement (*Scotland*) Act, 1862."

^a This Act should be read in conjunction with the Local Government (Ireland) Act, 1858, sections 30 and 68, to 75 inclusive, and 78; the Local Government Amendment Act, 1861, sections 4, 5, and 6; the Public Health Act, 1866, sections 45 and 46; and the Public Health (Ireland) Act, 1874, secs. 7, 12, 13, and 26. Only extracts from the two former acts are given in this work.

^b Sec. 57 Sanitary Act, 1866, defines the Sewer Authority to be the Nuisance Authority for executing the Nuisances Removal Act.

^c For definition of "Sewer Authority" see the first section of the Sanitary Act, 1866.

404 *The Sewage Utilization Act, 1865.*

Power of entry.

5. The Sewer Authority shall have the powers of entry conferred by the one hundred and forty-third section of the "Public Health Act, 1848,"^a for the purposes of making or keeping in repair any works made or to be made by them, as well as for the purposes specified in the said section.

Payment of expenses.

6. A Sewer Authority shall pay all expenses incurred by them in carrying this act into effect out of the fund or rate in the schedule in that behalf mentioned, and shall have all such powers of borrowing money on the security of such fund or rate as local boards have of borrowing money under "The Local Government Act, 1838," and the acts amending that act, on the security of the funds or rates in the said acts in that behalf mentioned, subject to the conditions and sanction under which such powers are exercised by local boards under the said acts.

Power to take lands.

7. A Sewer Authority shall, for the purposes of this act, have the powers of taking lands conferred on local boards by the seventy-fifth section of "The Local Government Act, 1858," and any act amending the same.

Compensation.

8. Full compensation shall be made, out of any fund or rate applicable to the purposes of this act, to all persons sustaining any damage by reason of the exercise of any of the powers of this act; and in case of dispute as to amount, the same shall be settled by arbitration, as provided in the Public Health Act, 1848, or any act amending the same, or if the compensation claimed do not exceed the sum of twenty pounds the same may be ascertained by and recovered before justices in a summary manner, in manner provided by the acts mentioned in this section.

Power of Sewer Authorities to combine.

9. Two or more Sewer Authorities, including under that expression, for the purposes of this section, local boards, may combine together for the purpose of executing and maintaining any works that may be for the benefit of their respective districts; and all moneys they may agree to contribute for the execution and maintenance of such common works shall, in the case of each authority, be deemed to be expenses incurred by them in the execution of works within their district, and shall be raised accordingly.

Sewer Authority may take proceedings to prevent pollution of streams.

10. A Sewer Authority, with the sanction of her Majesty's Attorney-General in *England*, and of the Attorney-General for *Ireland* in *Ireland*, and of the Lord-Advocate in *Scotland*, may, either in its own name or in the name of any other person, with the consent of such person, take such proceedings by indictment, bill in Chancery, action, or otherwise, as it may deem advisable, for the purpose of protecting any watercourse within its jurisdiction from pollutions arising from sewage either within or without its district; and the costs of and incidental to any such proceedings, including any costs that may be awarded to the defendant, shall be deemed to be expenses properly incurred by the Sewer Authority in carrying into effect the purposes of this act.

Sewers not allowed to drain into any stream, &c.

11. Nothing contained in this act, or in the acts referred to therein, shall authorise any Sewer Authority to make a sewer so as to drain direct into any stream or watercourse.

Power to Public Works Loan Commissioners to lend money to Sewer Authorities.

12. The Public Works Loan Commissioners, as defined by the Public Works Loan Act, 1853, may advance to any Sewer Authority, upon the security of any rate applicable to the purposes of this act, without any further security, such sums of money as may be recommended by one of her Majesty's principal Secretaries of State, to be applied by such authority in carrying into effect the purposes of this act.^b

^a See 143rd section of the Public Health Act, 1848.

^b In *Ireland* the Local Government Board and the Commissioners of Public Works.

13. All powers given by this act shall be deemed to be in addition to and not in derogation of any other powers conferred on any Sewer Authority by Act of Parliament, law, or custom; and the Sewer Authority may exercise such other powers in the same manner as if this act had not passed. Powers of Act cumulative.

14. The Sewer Authority of any place may from time to time, for the purpose of utilising its sewage, agree with any person or body of persons, corporate or unincorporate, as to the supply of such sewage, and works to be made for the purpose of that supply, and the parties to execute the same and to bear the costs thereof, and the sums of money, if any, to be paid for that supply: provided that no contract shall be made for the supply of sewage for a period exceeding twenty-five years. Sewer Authority may enter into contract for supply of sewage.

15. The making of works of distribution and service for the supply of sewage to lands for agricultural purposes shall be deemed an "improvement of land" authorised by the Land Improvement Act, 1864, and the provisions of that act shall apply accordingly. Application of 27 and 28 Vict., c. 114, for works, &c., for supply of sewage.

16. The Commissioners of Public Works in *Ireland* shall, in respect to any Sewage Authority or sewage matter in *Ireland*, have and exercise all the powers conferred by this act or any act incorporated herewith on one of her Majesty's principal Secretaries of State; and all applications by this act, or any act incorporated herewith, authorised or directed to be made to one of her Majesty's principal Secretaries of State in respect to sewage matters, or the powers conferred by this act on Sewage Authorities, shall in *Ireland* be made to the Commissioners of Public Works; and all orders made on such applications by said Commissioners shall have the same force and effect as orders made by one of her Majesty's principal Secretaries of State on similar applications in *England* and *Scotland*. Board of Works in Ireland to have power of Secretary of State in sewage matters.

SCHEDULE.

ENGLAND AND WALES.

Description of Local Authority.	Description of Places.	Rate or Fund out of which Expenses to be paid.
The Mayor, Aldermen, and Burgesses acting by the Council.	In Boroughs, with the exception of the Boroughs of Oxford and Cambridge, not within the Jurisdiction of a Local Board.	The Borough Fund or Borough Rate.
The Commissioners, Trustees, or other Persons entrusted by any Local Act of Parliament with powers of improving, cleansing, lighting, or paving the town.	The Boroughs of Oxford and Cambridge, and any Town or place not included within the above descriptions, and under the jurisdiction of Commissioners, Trustees, or other Persons entrusted by any Local Act with powers of improving, cleansing, lighting, or paving any town.	Any rate leviable by the Commissioners, trustees, or other persons.
The Vestry, Select Vestry, or other body of Persons acting by virtue of any Act of Parliament, Prescription, Custom, or otherwise, as or instead of a Vestry or Select Vestry.	In parishes not within the jurisdiction of any Sewer Authority hereinbefore mentioned, and in which a rate is levied for the maintenance of the poor.	The Poor Rate.

SCOTLAND.

Description of Local Authority.	Description of Places.	Rate or Fund out of which Expenses to be paid.
The Town Council.	Places within the jurisdiction of any Town Council, and not subject to the separate jurisdiction of Police Commissioners or Trustees.	The revenue of the Burgh, or any rate applicable to sewers leviable by the Town Council.
The Police Commissioners or Trustees.	In places where Police Commissioners or trustees exercise the functions of Police Commissioners or trustees under any General or Local Act.	Any rate leviable by the Commissioners or trustees, or any Fund belonging to them.
The Parochial Board.	Any Town or Village not included in the above descriptions.	The Poor Rate.

IRELAND. *a*

The Right Hon. the Lord Mayor, Aldermen, and Burgesses.	The City of Dublin.	The District Sewer Rate.
The Mayor, Aldermen, and Burgesses.	Towns Corporate or Boroughs (with the exception of Dublin).	Any rate leviable by the Town Council, or any fund belonging to them, applicable in the whole or in part to the making or repairing of sewers within their jurisdiction.
The Town Commissioners or other Governing Body.	Towns having Town Commissioners under 9 G. IV., c. 82, or 17 and 18 Viet., c. 103, or any Acts amending the same, or having Commissioners or other Governing Body under any Local Act.	Any rate leviable by these bodies, or any fund belonging to them, applicable in the whole or in part to the making or repairing of sewers within their jurisdiction.
The Board of Guardians or any Committee thereof appointed by the Board.	Any Town or Village in any Union not included in the above descriptions.	The Poor Rate; but the expenses to be charged only on the Electoral Division in which the Town or Village is situated.

a This Schedule has been amended by the Sanitary Act, 1866, sec. 56, the first Schedule. See also the Public Health Act, 1874.

AN ACT TO AMEND CERTAIN PROVISIONS IN THE
SANITARY AND SEWAGE UTILIZATION ACTS.

33 & 34 VICT., CAP. 53.

[9th August, 1870.]

1. This act may be cited for all purposes as "The Sanitary Act Short title.
1870."

2. For the purposes of the twenty-sixth section of the Sanitary Act, 1866, every hospital or place for the reception of the sick situate within the limits of the metropolis, as defined by the Metropolis Management Act, 1855, shall be deemed to be within the district of every one of the nuisance authorities in the metropolis.

3. Any notice which by virtue of such provisions of the act of the fifty-eighth year of the reign of King George the Third, chapter sixty-nine, or any of the acts amending the same or incorporated therewith, as are incorporated by the fifth section of the Sanitary Act, 1866, is required to be signed by the rector, vicar, or curate, or by a churchwarden or overseer of the poor of the parish, shall in the case of any special drainage district made up of, including part of a parish only, or more than one parish, be signed by the rector, vicar, or curate, or by a churchwarden or overseer of the poor of any parish wholly or partly included in the district, and any notice which by the said acts or any of them is required to be affixed on or near to the doors of all churches and chapels within the parish shall be affixed to the doors of any church or chapel in the special drainage district, or if there be no such church or chapel, then on the doors of all churches and chapels in the parish or parishes out of which the district has been constituted.

4. Any order or demand of any of her Majesty's principal Secretaries of State under the Sanitary and Sewage Utilization Acts shall be deemed to have been duly served on the sewer authority of any district for the purposes of those acts if served on or sent through the post in a registered letter addressed to any person appointed at a meeting of the sewer authority to receive service, of which appointment notice shall be given to such Secretary of State, or if no such person shall have been appointed, or no notice of such appointment given to the Secretary of State as aforesaid, or if the person so appointed shall refuse, neglect, or be unable to receive such service, then if served on or sent by the post as aforesaid to the rector, curate, or overseer, or the churchwarden or overseer of any parish wholly or partly included in the district: provided that nothing in this act shall be taken to affect the provisions of the fifth section of the Sanitary Loans Act, 1869.

All hospitals in metropolis held to be within district of every nuisance authority for purposes of sec. 26, of the Sanitary Act, 1866.

How notices shall be given in special drainage districts consisting of part of a parish or made up by more than one parish.

How orders and demands are to be served or sent in special drainage districts.

AN ACT TO AMEND "THE SANITARY ACT, 1866."

31 and 32 VICT. C. 115.

[31st July, 1868.]

1. This act may be cited for all purposes as The Sanitary Act, 1868.

a2. This act shall not extend to *Scotland* or *Ireland*.

Short title.
Application of Act.

a Extended to Ireland by 34 and 35 Vict., c. 109, sec. 22, page 370.

Definition of
"Sewer
Authority."

Power to Sewer
Authority in
relation to
Privies.

3. "Sewer Authority" in this act shall have the same meaning as it has in the Sewage Utilization Act, 1865.

4. The following sections of the Public Health Act, 1848, as amended by any subsequent act of parliament; that is to say,

(1.) The fifty-first section, requiring every new house and every house pulled down to or below the ground floor and rebuilt to have a sufficient water-closet or privy and ashpit;

(2.) And the fifty-fourth section as amended by any subsequent act of parliament, providing that the Local Board of Health shall see that drains, water-closets, privies, and ashpits within their district do not become a nuisance;

shall extend to the district of every Sewer Authority in which there is no enactment of any public or private act of parliament to the like effect in force; and the said sections when so extended shall be construed in reference to the district of any Sewer Authority as if the expression "Sewer Authority" were inserted therein in the place of the expression "Local Board," and any officer for the time being appointed by the Sewer Authority to examine any premises shall be deemed to be the surveyor within the meaning of the said sections.

Where the Sewer Authority and the Nuisance Authority of a district are different bodies of men, the jurisdiction of the Nuisance Authority shall cease within such district in relation to all matters within the purview of the said sections of the Public Health Act, 1848; and any Sewer Authority to whose district the said sections are extended making default in enforcing their provisions shall be subject to proceedings under the Sanitary Act, 1866, in the same manner as if it had made default in providing its district with sufficient sewers.

Power of Sewer
Authorities to
Sewerage.

5. A Sewer Authority shall within their district have all the powers vested in a Local Board by the thirty-second section of the Local Government Act, 1858, as amended by any subsequent act of parliament, so far as relates to—

(1.) The removal of house refuse from premises;

(2.) The cleansing of privies, ashpits, and cesspools;

and the paragraphs numbered (1), (2), and (3) of the said section shall be construed in reference to the district of any Sewer Authority as if the expression "Sewer Authority" were inserted therein in the place of the expression "Local Board."

Where the Sewer Authority and the Nuisance Authority are different bodies of men, the jurisdiction of the Nuisance Authority in such district shall cease in respect to all matters over which the Sewer Authority acquires powers by this section.

Incorporation of
Provisions of
11 and 12 Vict.,
c. 63, as to
private Im-
provement
Expenses.
Earth closets
may in certain
cases be
constructed
instead of water-
closets.

6. The provisions of the Public Health Act, 1848, relating to private improvement expenses, as amended by any subsequent act of parliament, shall be deemed to be incorporated with this act, so far as may be required for carrying into effect any provision of this act.

7. Any enactment of any act of parliament in force in any place requiring the construction of a water-closet shall, with the approval of the local authority, be satisfied by the construction of an earth-closet, or other place for the reception and deodorization of fecal matter, made and used in accordance with any regulation from time to time issued by the local authority.

The local authority may, as respects any houses in which such earth-closets or other places as aforesaid are in use with their approval, dispense with the supply of water required by any contract or enactment to be furnished to the water-closets in such houses, on such terms as may be agreed upon between such authority and the persons or body of persons providing or required to provide such supply of water.

The local authority may themselves undertake or contract with any person to undertake a supply of dry earth or other deodorizing substance to any house or houses within their district for the purpose of any earth-closets or other places as aforesaid.

The local authority may themselves construct or require to be constructed earth-closets or other such places as aforesaid in all cases where, under any enactment in force, they might construct water-closets or privies, or require the same to be constructed, with this restriction, that no person shall be required to construct an earth-closet or other place as aforesaid in any house instead of a water-closet if he prefer to comply with the provisions of the enactment in force requiring the construction of a water-closet, and a supply of water for other purposes is furnished to such house, and that no person shall be put to greater expense in constructing an earth-closet or other place as aforesaid than he would be put to by compliance with the provisions of any enactment as to water-closets or privy accommodation which he might have been compelled to comply with if this section had not been passed.

Local authority shall, for the purposes of this act, mean any local board and any sewer authority.

8. Whereas by the forty-ninth section of the Sanitary Act, 1866, power is given to one of her Majesty's principal Secretaries of State, in case of any sewer authority, local board, or nuisance authority making default in performing the sanitary duties specified in the said section, and imposed on them by act of parliament, to appoint a person to perform the same, and to direct by order that the expenses of performing the same, together with a reasonable remuneration to the person appointed for superintending such performance, and amounting to a sum specified in the order, together with the costs of the proceedings, shall be paid by the authority in default, and that any order made for the payment of such costs and expenses may be removed into the Court of Queen's Bench, and be enforced in the same manner as if the same were an order of such court; and whereas it is expedient to make further provision for enforcing payment of any sum so specified as aforesaid in the order of the Secretary of State, together with the costs of the proceedings occasioned by the default made in payment of such sum:

Provision for
Recovery of
Expenses by
Secretary of
State.

Be it enacted, that the sum so specified in the order of the Secretary of State, together with the costs of the proceedings, shall be deemed to be expenses properly incurred by the authority in default and to be a debt due from such authority, and payable out of any moneys in the hands of such authority or their officers, or out of any rate applicable to the payment of any expenses properly incurred by the defaulting authority, and which rate is in this section referred to as the local rate; and in the event of any authority refusing to pay any such sum with costs as aforesaid for a period of fourteen days after demand, the Secretary of State may by precept empower any person to levy by and out of the local rate such sum (the amount to be specified in the precept) as may, in the opinion of the said Secretary of State, be sufficient to defray the debt so due from the defaulting authority, and all expenses incurred in consequence of the non-payment of such debt; and any person or persons so empowered shall have the same powers of levying the local rate, and requiring all officers of the defaulting authority to pay over any moneys in their hands, as the defaulting authority itself would have in the case of expenses legally payable out of a local rate to be raised by such authority; and the said person or persons, after repaying all sums of money so due in respect of the precept, shall pay the overplus, if any (the amount to be ascertained by the Secretary of State), to or to the order of the defaulting authority.

9. Penalties under any section incorporated with this act shall be recovered in manner directed by the act passed in the session holden in the eleventh and twelfth years of the reign of her present Majesty, chapter forty-three.

As to recovery
of Penalties.

All powers conferred by this act shall be deemed to be in addition to and not in derogation of any other powers conferred by any other act of parliament, and any such other powers may be exercised as if this act had not passed.

410 *Common Lodging Houses Act, 1851.*

Nothing in this act contained shall be deemed to exempt any person from any penalty to which he would have been liable if this act had not been passed.

Provided that no person who has been adjudged to pay any penalty in pursuance of this act shall for the same offence be liable to a penalty under any other act.

Amendment of
Secs 37 of 29.
and 30 Vict.,
c. 90.

10. The Sewer Authority, or in the metropolis the Nuisance Authority, shall have the like power to make provision for the temporary supply of medicine and medical assistance for the poorer inhabitants as it now has to provide hospitals or temporary places for the reception of the sick under the thirty-seventh section of "The Sanitary Act, 1866;" but such power to make provision for the temporary supply of medicine and medical assistance shall not be exercised without the sanction of her Majesty's Privy Council.

Construction
of First Part of
the Sanitary
Act, 1866.

11. In the construction of the first part of the Sanitary Act, 1866, "Owner" shall have the same meaning as it has in the second part of the said act; and notices may be served for the purposes of the first part of the said act in the same manner in which they are required to be served under the second part of the said act.

ACTS RELATING TO LODGINGS, TENEMENTS, AND BAKEHOUSES, ACCORDING TO THEIR DATES.

COMMON LODGING HOUSES ACT, 1851.

14 & 15 VICTORIA, CAP. 28.

An Act for the well-ordering of Common Lodging Houses.

[24th July, 1851.]

Whereas it would tend greatly to the comfort and welfare of many of her Majesty's poorer subjects if provision were made for the well-ordering of common lodging houses: be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows; to wit,

Short title.

1. In citing this act for any purpose, it shall be sufficient to use the expression "The Common Lodging Houses Act, 1851."

Interpretation
of terms in this
Act.

2. The following words and expressions in this act have, for the purposes and execution of this act, the following meanings; to wit,

The word "place" includes county, riding, hundred, and other division or part of a county, city, borough, parish, district, and other place whatsoever:

The word "borough," and the expressions "mayor, aldermen, and burgesses," and "borough fund," have respectively the same

meaning as in the Act for the Regulation of Municipal Corporations :

The expression "improvement act" means an act for regulating and managing the police of, and for draining, cleansing, paving, lighting, watching, and improving a place, and an act for any of those purposes :

The expression "common lodging house" includes, in any case in which only a part of a house is used as a common lodging house, the part so used of such house.

3. This act shall be executed as follows ; to wit,

By whom the
Act is to be
executed.

1. Within and for all or any part of the metropolitan police district by "The Commissioners of Police of the Metropolis," or such one of them as is from time to time appointed in that behalf by one of her Majesty's principal Secretaries of State.

2. Within and for all and any part of any place not being within the metropolitan police district, but being now or hereafter the district of a local board of health, by the local board of health for the district :

3. Within and for all and any part of any other place not being within the metropolitan police district, and not being the district of a local board of health, but being now or hereafter an incorporated borough regulated under the Act for the Regulation of Municipal Corporations, or any act for the amendment thereof, or any charter granted in pursuance of any such act, by the mayor, aldermen, and burgesses of the borough acting by the council of the borough :

4. Within and for all and any part of any other place not being within the metropolitan police district, and not being the district of a local board of health, and not being such an incorporated borough, but being now or hereafter the place within the limits of an improvement act, by the commissioners, trustees, or other body, by whatever name known, for executing the improvement act :

5. Within and for all and any part of any other place not being one of the places hereinbefore specified, by the justices of the peace acting in petty sessions for the place.

4. The expenses of and incident to the executing of this act shall be borne and paid as follows ; to wit,

As to expenses
of executing this
act.

[Sections 3 & 4 are apparently superseded by 23 Vict., c. 26, page 416]

1. With respect to the metropolitan police district, as part of the general expenses of executing the acts for the time being in force relating to the metropolitan police force :

2. With respect to the district of a local board of health, as part of the expenses of executing the acts for the time being in force relating to the local board of health, and as charged upon and payable out of the moneys carried, under the Public Health Act, 1848, to the district fund account of the local board of health :

3. With respect to an incorporated borough, as part of the expenses of carrying into execution within the borough the provisions of the Act for the Regulation of Municipal Corporations, and as charged upon and payable out of the borough fund of the borough :

4. With respect to a place within the limits of an improvement act, as part of the general expenses of executing that act, and as charged upon and payable out of the moneys from time to time applicable for those expenses :

5. With respect to a place in which this act is executed by justices in petty sessions, as part of the general expenses of the constabulary of the place, and as charged upon and payable out of the moneys from time to time applicable for those expenses :

And the moneys from time to time required for the payment of the expenses of and incident to the execution of this act shall be assessed, levied, raised, recovered, and paid accordingly.

5. The expression in this act "the local authority" means, with re-

Meaning of the
term "the local
Authority."

412 *Common Lodging Houses Act, 1851.*

Notice of this Act to be given to the keepers of common lodging houses.

Registers of common lodging-houses to be kept.

Lodgers not to be received in common lodging-houses until registered under this Act.

Power to Local Authority to make regulations respecting common lodging houses.

Power to Local Authority to impose penalties for offences committed against regulations.

Keepers of common lodging-houses to give notice of fever, &c., therein.

As to inspection of common lodging houses.

As to cleansing of common lodging houses.

spect to the purposes and execution of this act with respect to any place, the body or person by this act authorized to execute with respect to the place the several provisions of this act.

6. Within three months after the passing of this act the local authority shall, and from time to time thereafter the local authority may, give to the keeper of every common lodging house already or hereafter within the jurisdiction under this act of the local authority notice in writing of this act, and shall give such notice by leaving the same for such keeper at the house, and shall by such notice require the keeper to register the house as by this act provided, and such notice^a may be in the form in the schedule to this act annexed, or to the like effect.

7. The local authority shall keep a register in which shall be entered the names and residences of the keepers of all common lodging houses within the jurisdiction of the local authority, and the situation of every such house and the number of lodgers authorized according to this act to be received therein.

8. After one month after the giving of such notice to register as by this act provided, the keeper of any common lodging house or any other person shall not receive any lodger in such house until the same has been inspected and approved for that purpose by some officer appointed in that behalf by the local authority, and has been registered as by this act provided.

9. ^b The local authority may from time to time make regulations respecting common lodging houses within its jurisdiction for all or any of the purposes respecting the same for which the local board of health are by the Public Health Act, 1848, authorized to make bye-laws, and for the well-ordering of such houses, and for the separation of the sexes therein : provided always, that the regulations made under this act by the local authority shall not be in force until they have been confirmed by one of her Majesty's principal Secretaries of State.

10. The local authority shall have the same power of imposing penalties on offenders against the said regulations, subject to the same restrictions, as the local board with respect to offenders against such bye-laws, and such penalties shall be recoverable in the same way as is provided in the said act with respect to the penalties imposed on offenders against such bye-laws ; and a copy of the said regulations, purporting to be signed by the Secretary of State, and also to be signed by the local authority (or to be sealed with the seal of the same, in case it have a seal), shall be receivable in evidence of such regulations, and of the duly making and confirming thereof.

11. The keeper of a common lodging house shall, when a person in such house is ill of fever or any infectious or contagious disease, give immediate notice thereof to the local authority, or some officer of the local authority, and also to the poor law medical officer and the poor law relieving officer of the union or parish in which the common lodging house stands.

12. The keeper of a common lodging house and every other person having or acting in the care or management thereof shall, at all times when required by any officer of the local authority, give him free access to such house or any part thereof.

13. The keeper of a common lodging house shall thoroughly cleanse all the rooms, passages, stairs, floors, windows, doors, walls, ceilings, privies, cesspools, and drains thereof, to the satisfaction of and so often as shall be required by or in accordance with any regulation or bye-law

^a See page 413.

^b The 9th and 10th sections of this act are repealed as to Ireland by sec. 4, 23 Vic., c. 26

of the local authority, and shall well and sufficiently, and to the like satisfaction, limewash the walls and ceilings thereof in the first week of each of the months of *April* and *October* in every year.

14. If the keeper of a common lodging house, or any other person having or acting in the care or management thereof, offend against any of the provisions of this act, or any of the bye-laws or regulations made in pursuance of this act, or if any person in any common lodging house be confined to his bed for forty-eight hours by fever or any infectious or contagious disease, without the keeper of such house giving notice thereof as required by this act, every person so offending shall for every such offence be liable to a penalty not exceeding five pounds, and to a further penalty not exceeding forty shillings for every day during which the offence continues: provided always, that this act shall not exempt any person from any penalty or other liability to which he may be subject irrespective of this act.

Penalty for offences against this Act.

15. The clauses and provisions of the Railways Clauses Consolidation Act, 1845, "with respect to the recovery of damages not specially provided for, and of penalties, and to the determination of any other matter referred to justices," are for the purposes and execution of this act incorporated with this act.

Recovery of penalties.

16. The local authority, and all justices, constables, and others, shall respectively have full jurisdiction, powers, authorities, and indemnities for executing the several provisions of this act; and the restrictions of the Public Health Act, 1848, as to the hours within which common lodging houses may be entered by persons authorized by a local board of health, shall not apply to this act.

General powers of Local Authority, &c.

17. That this act shall not extend to the city of *London* or the liberties thereof.

Act not to extend to the City of London, nor to Scotland.

18. That nothing in this act shall extend to *Scotland*.

SCHEDULE.

FORM OF NOTICE.

Take notice, that on the [] day of [] an act called "The Common Lodging Houses Act, 1851," was passed, and that before the [] day of [] you, being the keeper of a common lodging house within [*here state the place over which the jurisdiction of the local authority giving the notice extends*], must have your common lodging house registered, and that the register is to be kept at [*here state where the register is to be kept*], and that if you do not have your common lodging house so registered you will be liable to a penalty not exceeding five pounds for every lodger whom you receive in your common lodging house while it is not so registered; and that on your applying to [*here give the name and address of the person to keep the register*] he will register your common lodging house free of all charge to you. Dated &c. [].

414 *Common Lodging Houses Act, 1853.*

THE COMMON LODGING HOUSES ACT, 1853.

16 & 17 VICTORIA, CAP. 41.

An Act for making further Provisions with respect to Common Lodging Houses.

[4th August, 1853.]

- Whereas it is expedient to extend the provisions of "The Common Lodging Houses Act, 1851;" be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :
- Short title.** 1. This act may be cited for any purpose as "The Common Lodging House Act, 1853."
- Recited Act and this Act to be as one.** 2. The Common Lodging Houses Act, 1851, and this act shall be construed and executed as if they were one act.
- All common lodging houses to be registered before being used, and to be kept only by registered keepers.** 3. After three months after the passing of this act a person shall not keep a common lodging house or receive a lodger therein until the house have been inspected and approved for that purpose by some officer appointed in that behalf by the local authority, and have been registered as by the recited act provided ; and a person shall not keep a common lodging house unless his name as the keeper thereof be entered in the register kept under the recited act : provided always, that when the person so registered dies, his widow or any member of his family may keep the house as a common lodging house for not more than four weeks after his death without being registered as the keeper thereof.
- Local Authority may refuse to register houses if keepers do not produce certificate of character** 4. The local authority may refuse to register as the keeper of a common lodging house a person who does not produce to the local authority a certificate of character in such form as the local authority shall direct, signed by three inhabitant householders of the parish respectively rated to the relief of the poor of the parish within which the lodging house is situated for property of the yearly rateable value of six pounds or upwards.
- Evidence of register.** 5. A copy of an entry made in a register kept under the recited act, certified by the person having the charge of the register to be a true copy, shall be received in all courts and before all justices and on all occasions whatsoever as evidence and be sufficient proof of all things therein registered, without production of the register or of any document, act, or thing on which the entry is founded ; and every person applying at a reasonable time shall be furnished gratis by the person having such charge with a certified copy of any such entry.
- Power to Local Authority to require an additional supply of water to common lodging houses.** 6. Where it appears to the local authority that a common lodging house is without a proper supply of water for the use of the lodgers, and that such a supply can be furnished thereto at a reasonable rate, the local authority may by notice in writing require the owner or keeper of the common lodging house, within a time specified therein, to obtain such supply, and to do all works necessary for that purpose ; and if the notice be not complied with accordingly, the local authority may remove the common lodging house from the register until it be complied with.
- As to removal of sick persons from common lodging houses to hospitals, &c.** 7. When a person in a common lodging house is ill of fever or any infectious or contagious disease, the local authority may cause such person to be removed to an hospital or infirmary, with the consent of the authorities thereof, and on the certificate of the medical officer of the parish, place, or district that the disease is infectious or contagious, and that the patient may be safely removed, and may, so far as the local

authority think requisite for preventing the spread of disease, cause any clothes or bedding used by such person to be disinfected or destroyed, and may, if the local authority think fit, award to the owners of the clothes and bedding so disinfected or destroyed reasonable compensation for the injury or destruction thereof, and such compensation shall be paid to such owners by the proper officer of the parish or union in which the common lodging house is situate, out of the rates applicable to the relief of the poor of such parish, the amount of such compensation being first certified in writing upon a list of such articles.

8. The keeper of a common lodging house in which beggars or vagrants are received to lodge, or other person having the care or management thereof, shall from time to time, if required by any order of the local authority served on such keeper or person, report to the local authority, or to such person or persons as the said local authority shall direct, every person who resorted to such house during the preceding day or night, and for that purpose schedules shall be furnished by the local authority to the person so ordered to report, which schedules they shall fill up with the information required, and transmit to the local authority.

Power to order reports from keepers of common lodging houses kept for beggars and vagrants.

9. The town council, trustees, commissioners, guardians, and other officers and boards specified in the first section of the "Nuisances Removal and Diseases Prevention Act, 1848," shall, on the receipt of a certificate of any police constable or of any officer appointed for the inspection of common lodging houses by the local authority, stating the existence in or about any common lodging house of any of the causes of complaint specified in that section, take all such proceedings as by that section are required to be taken by the town council, trustees, commissioners, guardians, and other officers and boards specified therein on a notice signed by two inhabitant householders, and in like manner as nearly as may be as if such notice had been given; and the local authority shall have the like powers, and shall take all such proceedings, on receipt of any such certificate of the existence of any such cause of complaint, as the town council, trustees, commissioners, guardians, and other officers or boards have and are empowered and required to take under the provisions of that act.

Power to Town Councils, &c., to remove causes of complaint certified under Nuisance Removal, &c., Act.

[10. Relates only to Oxford and Cambridge.]

11. The fourteenth section of the recited act extends to offences against any of the provisions of this act, so as to render the offenders liable to the penalties therein expressed; and any person convicted of any offence against the recited act and this act, or either of them, may, in default of payment of the penalty imposed, be imprisoned for any term not exceeding three months in the manner provided by law in that behalf.

As to offences against this Act.

12. Where a keeper of a common lodging house, or a person having or acting in the care or management of a common lodging house, is convicted of a third offence against the recited act and this act, or either of them, the justices before whom the conviction for such third offence takes place may, if they think fit, adjudge that he shall not at any time within five years after the conviction, or within such shorter period after the conviction as the justices think fit, keep or have or act in the care or management of a common lodging house without the previous licence in writing of the local authority, which licence the local authority may withhold or may grant on such terms and conditions as they think fit.

Conviction for third offence to disqualify persons from keeping common lodging house.

13. In a case in which there are not petty sessions for a place fifthly mentioned in section three of the recited act, that act and this act may be executed within and for all and any part of such place by the justices of the peace acting in petty sessions in the petty sessional division within which such place is comprised.

Acts may be executed by Justices at Petty Sessions.

14. Where in any place the recited act and this act are executed by justices in petty sessions, the expenses of and incident to the executing

As to expenses of executing Act by Justices.

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of the recited act and this act with respect to such petty sessional division shall be borne by and paid out of the rates for the relief of the poor of the several parishes or other places comprised therein in which any common lodging house is situate (except so far as there are other moneys applicable to the purpose), and the amount of such expenses shall be ascertained and apportioned by such justices, and shall be paid accordingly as they order.

THE COMMON LODGING HOUSES (IRELAND) ACT, 1860.

23 VICTORIA, CAP. 26.

An act to remove Doubts as to the application of "The Common Lodging Houses Acts" to *Ireland*, and to amend the Provisions of the same so far as they relate to *Ireland*.

[25th May, 1860.]

14 and 15 Vict.,
c. 28.
16 and 17 Vict.,
c. 41.

Whereas doubts have arisen as to whether "The Common Lodging Houses Act, 1851," and "The Common Lodging Houses Act, 1853," extend to *Ireland*, and difficulties have occurred in the execution of the said acts therein; and it is expedient that such doubts and difficulties should be removed, and for that purpose that the said acts should be explained and amended with reference to the execution thereof in *Ireland*: be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows (that is to say):

Short title.

Recited Acts
and this Act to
be construed as
one, and to
extend to
Ireland.

Explanation of
certain Terms in
recited Acts and
this Act.

1. In citing this act for any purpose it shall be sufficient to use the expression "The Common Lodging Houses Act, *Ireland*, 1860."

2. This act and "The Common Lodging Houses Act, 1851," and "The Common Lodging Houses Act, 1853," shall, for the purpose of the execution thereof in *Ireland*, be construed as if they were one act, and the said acts as hereby amended shall be deemed to extend to *Ireland*.

3. For the purpose of the execution of the said recited acts and of this act in *Ireland*, certain words and expressions used in the said acts are hereby declared and explained to have been intended to bear the following meanings; (that is to say),

The word "place" includes electoral division:

The words "poor law medical officer," and "medical officer of the parish, place, or district," mean the medical officer of the dispensary district within which any common lodging house is situate:

"The Act for the Regulation of Municipal Corporations" means the act passed in the third and fourth years of the reign of her Majesty, intituled *An Act for the Regulation of Municipal Corporations* in *Ireland*:

The term "common lodging house" shall mean a house in which persons are harboured or lodged for hire for a single night, or for less than a week at a time, or any part of which is let for any term less than a week:

The term "local authority" shall have the following meanings: in boroughs, incorporated under the above-mentioned act for the

regulation of municipal corporations, or any charter granted or to be granted in pursuance of it, it shall mean the town council of such borough; in towns having town commissioners elected or appointed under any Act of Parliament, it shall mean such town commissioners; in all other places it shall mean the poor law guardians of the union.

4. The ninth and tenth sections of "The Common Lodging Houses Act, 1851," are hereby repealed as to *Ireland*, and the following provisions substituted therefor as to *Ireland*: The local authority may make bye-laws respecting common lodging houses, for the well-ordering of such houses, and for the separation of the sexes therein, and for fixing the number and sex of the lodgers who may be received into each such house, and for promoting cleanliness and ventilation therein, and with respect to the inspection thereof: provided that such bye-laws shall not be repugnant to law, and shall not be in force until they shall have been confirmed by the Lord Lieutenant or other the Chief Governor or Governors of *Ireland* for the time being; and that any bye-laws heretofore made under the provisions of the said recited acts shall continue in full force and effect until new bye-laws shall have been made and confirmed in lieu thereof, under the provisions of this act.

Local Authority to make Bye-laws respecting common lodging houses, but such Bye-laws to be confirmed by the Lord Lieutenant.

Old Bye-laws to continue until new ones are confirmed.

5. A copy of the bye-laws made by the local authority under the provisions of this act, purporting to be signed by the Chief or Under Secretary for *Ireland* on behalf of the Lord Lieutenant, and also signed by the local authority (or sealed with the seal of the same, in case it have a seal), shall be received as evidence of such bye-laws, and of their having been duly made and confirmed.

Copy of Bye-laws to be received in evidence.

6. The penalties imposed by "The Common Lodging Houses Act, 1851," for offences against bye-laws made under the provisions of the said recited act, shall apply to the bye-laws made under the provisions of this act, and such penalties shall be recoverable before justices of the peace at Petty Sessions; and all the provisions of the Petty Sessions Act, *Ireland*, shall apply to the proceedings for recovery of such penalty.

Penalties imposed by 14 and 15 Vict., c. 28, to apply to Bye-laws made under this Act.

7. The expenses of the execution of the said acts and of this act are to be defrayed in boroughs out of the borough fund, in towns having town commissioners out of the rates levied by such commissioners, and in other places out of the rates for the relief of the destitute poor.

Expense to be levied off the whole of an Electoral Division.

8. Nothing herein contained shall affect any provision of the Towns Improvement, *Ireland*, Act, or any bye-law duly made under its provisions.

Not to affect Provisions of 17 and 18 Vict., c. 103.

9. All acts and proceedings for the execution and enforcement of the provisions of the said Common Lodging Houses Acts shall be as valid as if said acts had originally included *Ireland*, but no adjudication already pronounced shall be affected hereby.

Former proceedings validated.

10. This act shall extend to *Ireland* only.

Extent of Act.

THE BAKEHOUSE REGULATION ACT, 1863.

26 & 27 VICTORIA, CAP. 40.

An Act for the Regulation of Bakehouses.^a[13th July, 1863.]

Whereas it is expedient to limit the hours of labour of young persons employed in bakehouses, and to make regulations with respect to cleanliness and ventilation in bakehouses : be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :

Short title.

1. This act may be cited as "The Bakehouse Regulation Act, 1863."

Interpretation of terms.

2. For the purposes of this act the words hereinafter mentioned shall be construed as follows ; that is to say,

"*Local Authority*" shall, as respects any place, mean the persons or bodies of persons defined to be the local authority in that place by the one hundred and thirty-fourth section of the act passed in the session holden in the eighteenth and nineteenth years of the reign of her present Majesty, chapter one hundred and twenty, or by the Nuisances Removal Acts hereinafter mentioned ; that is to say, as to *England*, by the act passed in the session holden in the eighteenth and nineteenth years of the reign of her present Majesty, chapter one hundred and twenty-one, as amended by the act passed in the session holden in the twenty-third and twenty-fourth years of the reign of her present Majesty, chapter seventy-seven ; as to *Scotland*, by the act passed in the session holden in the nineteenth and twentieth years of the reign of her present Majesty, chapter one hundred and three ; and as to *Ireland*, by the acts passed, the one in the session holden in the eleventh and twelfth years of the reign of her present Majesty, chapter one hundred and twenty-three, and the other in the session holden in the twelfth and thirteenth years of the reign of her present Majesty, chapter one hundred and eleven :

"Bakehouse" shall mean any place in which are baked bread, biscuits, or confectionary, from the baking or selling of which a profit is derived :

"Employed," as applied to any person, shall include any person working in a bakehouse, whether he receives wages or not :

"Occupier" shall include any person in possession :

"The Court" shall include any justice or justices, sheriff or sheriff substitute, magistrate or magistrates, to whom jurisdiction is given by this act.

Limitation of hours of labour of persons under 18 years of age.

3. No person under the age of eighteen years shall be employed in any bakehouse between the hours of nine of the clock at night and five of the clock in the morning.

If any person is employed in contravention of this section, the occupier of the bakehouse in which he is employed shall incur the following penalties in respect of each person so employed ; that is to say,

For the first offence, a sum not exceeding two pounds :

For a second offence, a sum not exceeding five pounds :

For a third and every subsequent offence, a sum not exceeding one

^a Bakehouses are not affected by the provisions of the Workshop Regulation Act, 1867, 30 & 31 Viet., Cap. 146. They may be considered as dwellings, seeing that the workmen usually sleep in them.

pound for each day of the continuance of the employment in contravention of this act, so that no greater penalty be imposed than ten pounds.

4. The inside walls and ceiling or top of every bakehouse situate in any city, town, or place, containing according to the last census a population of more than five thousand persons, and the passages and staircase leading thereto, shall either be painted with oil or be limewashed, or partly painted and partly limewashed : where painted with oil there shall be three coats of paint, and the painting shall be renewed once at least in every seven years, and shall be washed with hot water and soap once at least in every six months : where limewashed the limewashing shall be renewed once at least in every six months.

Regulations as to cleanliness of bakehouse.

Every bakehouse, wherever situate, shall be kept in a cleanly state, and shall be provided with proper means for effectual ventilation, and be free from effluvia arising from any drain, privy, or other nuisance.

If the occupier of any bakehouse fails to keep the same in conformity with this section, he shall be deemed to be guilty of an offence against this act, and to be subject in respect of such offence to a penalty not exceeding five pounds.

The court having jurisdiction under this act may, in addition to or instead of inflicting any penalty in respect of an offence under this section, make an order directing that within a certain time to be named in such order certain means are to be adopted by the occupier for the purpose of bringing his bakehouse into conformity with this section ; the court may upon application enlarge any time appointed for the adoption of the means directed by the order, but any non-compliance with the order of the court shall, after the expiration of the time as originally limited or enlarged by subsequent order, be deemed to be a continuing offence, and to be punishable by a penalty not exceeding one pound for every day that such non-compliance continues.

5. No place on the same level with a bakehouse situate in any city, town, or place, containing according to the last census a population of more than five thousand persons, and forming part of the same building, shall be used as a sleeping place, unless it is constructed as follows ; that is to say,

As to sleeping places near bakehouses.

Unless it is effectually separated from the bakehouse by a partition extending from the floor to the ceiling :

Unless there be an external glazed window of at least nine superficial feet in area, of which at the least four and a half superficial feet are made to open for ventilation :

And any person who lets, occupies, or continues to let, or knowingly suffers to be occupied, any place contrary to this act shall be liable for the first offence to a penalty not exceeding twenty shillings, and for every subsequent offence to a penalty not exceeding five pounds.

6. It shall be the duty of the local authority to enforce within their district the provisions of this act, and in order to facilitate the enforcement thereof, any officer of health, inspector of nuisances, or other officer appointed by the local authority, hereinbefore referred to as the inspector, may enter into any bakehouse at all times during the hours of baking, and may inspect the same, and examine whether it is or not in conformity with the provisions of this act ; and any person refusing admission to the inspector, or obstructing him in his examination, shall for each offence incur a penalty not exceeding twenty pounds ; and it shall be lawful for any inspector who is refused admission to any bakehouse, in pursuance of this section, to apply to any justice for a warrant authorizing him, accompanied by a police constable, to enter into any such bakehouse for the purpose of examining the same, and to enter the same accordingly.

Power to Local Authority to enforce provisions of this Act.

7. All expenses incurred by any local authority in pursuance of the provisions of this act may be paid out of any rate leviable by them, and applicable to the payment of the expenses incurred by the local authority

As to expenses of Local Authority acting under this Act.

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under the said Nuisances Removal Acts, and the said authority may levy such rate accordingly.

Penalties.

Recovery of penalties.

8. All penalties under this act may be recovered summarily before two or more justices; as to *England*, in manner directed by an act passed in the session holden in the eleventh and twelfth years of the reign of her Majesty Queen *Victoria*, chapter forty-three, intituled *An Act to Facilitate the Performance of the Duties of Justices of the Peace out of Sessions within England and Wales with respect to Summary Convictions and Orders*, or any act amending the same; as to *Ireland*, in manner directed by the act passed in the session holden in the fourteenth and fifteenth years of the reign of her Majesty Queen *Victoria*, chapter ninety-three, intituled *An Act to Consolidate and Amend the Acts regulating the Proceedings of Petty Sessions and the Duties of Justices of the Peace out of Quarter Sessions in Ireland*, or any act amending the same; and as to *Scotland*, upon summary conviction, with power for the justices having cognizance of the case to sentence the offender to imprisonment for a period not exceeding three months, until the penalty and the expenses of conviction are paid.

Jurisdiction of certain Magistrates.

9. Any act, power, or jurisdiction hereby authorized to be done or exercised by two justices may be done or exercised by the following magistrates within their respective jurisdictions; that is to say, as to *England*, by any metropolitan police magistrate or other stipendiary magistrate sitting alone at a police court or other appointed place, or by the Lord Mayor of the city of *London*, or any alderman of the said city sitting alone or with others at the *Mansion House* or *Guildhall*; as to *Ireland*, by any one or more divisional magistrates of police in the police district of *Dublin*, and elsewhere by one or more justice or justices of the peace in petty sessions; and as to *Scotland*, by the sheriff or sheriff substitute, or by any police magistrate of a burgh.

AN ACT TO ENCOURAGE THE ESTABLISHMENT OF LODGING HOUSES FOR THE LABOURING CLASSES IN IRELAND.

[28th June, 1866.]

29 AND 30 VICT., CAP. 44.

Short title,

1. Short Title: "The Labouring Classes Lodging Houses and Dwellings Act (Ireland), 1866."

Interpretation of terms.

2. [Defines that "Dwelling-houses" shall include lodging-houses; "Borough," means any city, borough, or town; "Council," the mayor, aldermen, and burgesses, or other the municipal corporation of any borough or any town having municipal commissioners under 3 and 4 Vict., c. 108; "Town Commissioners," any commissioners entrusted with the paving, lighting, or cleansing of any borough, or any commissioners in any townships under local acts; "Person" shall include persons; "Public Works Commissioners," the Commissioners of Public Works in Ireland; "Lords of the Treasury," the Lords Commissioners of her Majesty's Treasury for the time being; "Rates," the rates, tolls, rents, income, and other moneys which under the provisions of any act shall be applicable for the general purposes of such act; "Lands," tene-

ments and hereditaments of whatsoever nature or tenure ; "Justice," justice of the peace for the county, division, liberty, borough, or place where the matter requiring the cognizance of such justice shall arise.]

3. This act may be adopted for any borough in Ireland which now has or may hereafter have any municipal corporation, or in which now exist or may hereafter exist any commissioners for the paving, lighting, or cleansing of the same, under any public or local act of Parliament or any charter, and any townships having commissioners under local acts.

Act may be adopted in any Borough.

4. [This section enables corporation or commissioners to adopt the act.]

5. Such council or town commissioners shall give not less than twenty-eight nor more than forty-two days public notice of their intention to take into consideration the propriety of adopting this act, and of the time and place for holding the meeting at which they will take it into consideration ; and if there be presented to such council or town commissioners at that meeting a memorial in writing, signed by not less than one-tenth in value of the persons liable to be rated to rates made by such council or town commissioners, requesting such council or town commissioners to postpone such consideration for a period of one year, then and in such case such consideration shall be postponed for such period of one year, and shall be entered on as soon after the expiration of the year of postponement as such council or town commissioners shall think fit.

On requisition of ratepayers the Council or Town Commissioners to postpone proceedings for one year.

6. The expenses of carrying this act into execution in any such borough in which it shall be so adopted shall be paid out of any rates which such council or such town commissioners may have power to impose for the purpose of paving, lighting, cleansing, or otherwise improving the borough, town, or township, and which rates it is hereby enacted may be increased for the purpose of defraying such expense, such increase to be subject to the approval of the Lords of the Treasury.

Expenses to be paid out of rates.

7. The net income arising from any lodging houses or dwellings built by any council or town commissioners after the payment of all outgoings, including the interest and instalments of principal of any borrowed money, shall be paid to the credit of the borough or town commissioners' fund, or otherwise in aid of the rates which may have been applied to the payment of the expenses aforesaid, and the council or town commissioners shall keep distinct accounts of their expenses, receipts, and liabilities with reference to the execution of this act, to be called "The Labourers' Dwellings Account."

Net Income to be paid to the credit of the Borough Fund.

8. For the purposes hereinafter mentioned, the Commissioners of Public Works in Ireland may, out of the funds from time to time at their disposal, advance on loan to any such council or town commissioners as aforesaid, or to any company, society, or person as hereinafter mentioned—namely, any railway company, or dock or harbour company or commissioners, or any other company, society, or association established for trading or manufacturing purposes in the course of whose business or in discharge of whose duties persons of the labouring class may be employed, any private person or persons entitled to any land held in fee-simple or fee-farm, or for lives renewable for ever, or for any term of years whereof not less than eighty years shall be unexpired ; and all such advances by way of loan shall be applied towards the purchase of land or buildings, and the erection, alteration, and adaptation of buildings to be used as dwellings for the labouring classes, and in providing all conveniences which may be deemed by the Commissioners of Public Works proper in connection with such dwellings ; and in the case of loan to any such council or town commissioners as aforesaid, the term "dwellings" in this section shall include lodging-houses formed or erected by them under the

Commissioners of Public Works may advance moneys to Companies, Societies, or Persons.

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Advances may be made whether Local or other Authority has power to borrow.

9. Any such advance may be made whether the local or other authority, body corporate, society, or person or persons receiving the same has or has not power to borrow on mortgage or otherwise independently of this act; but nothing in this act contained shall repeal or alter any regulation, statutory or otherwise, whereby any company may be disabled from borrowing until a definite portion of capital is subscribed for, taken, or paid up, and no such advance shall be made without the approval of the Lords of the Treasury.

10. [Commissioners of Public Works may make rules relative to loans.]

Period for repayment of Advances.

11. The period for the repayment of such advances shall be regulated by the Public Works Commissioners, with the sanction of the Commissioners of the Treasury, and shall in no case exceed forty years.

Security for such Advances.

12. The repayment of any such money so advanced, with interest thereon at any rate not less than four pounds per cent. per annum, shall be secured as follows—namely, in the case of an advance to any such council or town commissioners, by a mortgage solely of said rates so leviable by them respectively as aforesaid, or by such mortgage as hereinafter mentioned, or by both, and in any other case by mortgage of the lands, buildings, or premises for the purposes of which such advance shall be made; and in the case of an advance to a company or society, any part of whose capital remains uncalled up or unpaid, by a mortgage also of all capital so uncalled up or unpaid; and any such mortgage may be taken either alone or together with any other security which may be agreed upon.

Money advanced on Security of Land not to exceed moiety of the Value.

13. The money so advanced on the security of any land or buildings shall not exceed one moiety of the value of the estate or interest in such land or buildings so proposed to be given in mortgage, and all such moneys may be advanced by instalments as may be agreed upon.

Council, Town Commissioners, or Society may appropriate lands.

14. Any such council or town commissioners, and every such other company, commissioners, society, or association, may appropriate for the purposes of this act any lands vested in them respectively, and they may also respectively purchase or take on lease any lands or buildings necessary for the purposes of this act; and every such commissioners, company, association, or society as aforesaid, for the purpose of taking and holding such lands, shall be deemed to be a body corporate, with right of perpetual succession: provided always, that no such council or town commissioners shall so appropriate, purchase, or take on lease any such lands or buildings without the sanction of the said Lords of the Treasury.

Enactments applicable to the acquisition of Lands by Railway Companies to apply.

15. For the purpose of the acquisition of any such lands or buildings by said council, town commissioners, commissioners, company, society, association, or person as aforesaid, all the statutory enactments for the time being applicable to the acquisition of lands by railway companies in Ireland (save so far as they relate to the taking of lands otherwise than by agreement) shall be deemed to be incorporated with this act; and for the purposes aforesaid this act shall be deemed the special act, and the said council or town commissioners, society, association, or person as aforesaid the promoters.

Buildings to be erected.

16. The said council or town commissioners, company, society, association, or person may from time to time, on any lands so appropriated, purchased, or rented, or contracted so to be, respectively erect any buildings suitable for the dwellings or lodging-houses, as the case may be, of the labouring classes, and convert any buildings so taken by them into such dwellings or lodging-houses, and may from time to time alter, enlarge, repair, and improve the same, and fit up, furnish, and supply the same respectively with all requisite furniture, fittings, and conveniences, and may enter into any contracts

for the purposes aforesaid, and may apply to the purposes aforesaid any funds at their disposal respectively.

17. Any such council or town commissioners, company, society, or association may enter into any contracts for the purpose of supplying any such lodging-houses provided or erected by them with gas, water, or other conveniences, and any commissioners or trustees for the supplying of any borough with gas or water may, if they shall think fit, supply gas or water to such lodging-houses without charge, or at any reduced charge, or on other favourable terms.

Council or Town Commissioners, &c., may enter into contracts.

18. Sections 56, 57, 58, 59, 60, 61, 62, 63, 64, 99, 100, 101, 102, 103 of the Commissioners Clauses Act, 1847,^a shall be incorporated with this act, so far as regards any such council, town commissioners, or any dock or harbour company or commissioners; and the term "commissioners" in the said clauses so incorporated shall mean and include any such council or town commissioners, dock or harbour company or commissioners, as aforesaid, and this act shall be deemed the special act for the purpose of such incorporation.

Certain Sections of 10 and 11 Vict., c. 16, to apply.

19. Any such council, town commissioners, railway company, or dock or harbour company or commissioners may, from time to time, with the sanction of the Lords of the Treasury, make sale and dispose of any lands, houses, or buildings vested in such council, commissioners, or company as last aforesaid for the purposes of this act, and may with the like sanction exchange any such lands, houses, or buildings for any others better suited for such purposes, with or without paying or receiving any money for equality of exchange, and the proceeds of all such sales shall be applied for the benefit of such council, commissioners, or company, or for the purposes of this act, in such manner as the said Lords of the Treasury may approve or direct.

Council, Town Commissioners, or Company may make sale of lands vested in them for the purposes of this Act.

20. The general management, regulation, and control of any lodging-houses established under this act by any such council or town commissioners shall (subject to the provisions of this act) be vested in such council or town commissioners respectively; and every lodging-house established under this act, and which shall be within the jurisdiction of any sanitary board, shall at all times be open to the inspection of such sanitary board, and the officers thereof from time to time authorised by such board to make such inspection.

Management and regulation to be vested in the Council or Town Commissioners.

21. That such council or town commissioners, company, society, association, or person may make bye-laws for the regulation of such lodging-houses, and from time to time vary and alter such bye-laws, and may appoint any penalty not exceeding five pounds for the breach by their officers respectively, or by any tenants or occupiers of such lodgings, of every such bye-law, and such bye-laws among other things shall make sufficient provision for the following purposes:—1. For securing that such lodging-houses shall be under the control of the officers and servants of the council or town commissioners, company, society, association, or person. 2. For securing the due separation at night of men and boys over eight years of age from women and girls. 3. For preventing damage, disturbance, interruption, indecent or offensive language and behaviour, and nuisances. 4. For determining the duties of the officers, servants, and others appointed by the council or town commissioners, company, society, association, or person: provided always, that no such bye-law shall be of any legal force until the same shall have received the approval of Local Government Board.

Council or Commissioners may make bye-laws for the following purposes.

22. A printed copy of such bye-laws shall be put up and at all times kept on every room of any such lodging-house.

Printed copy of bye-laws to be put up.
Proof of bye-laws

23. The production by any such council or town commissioners,

company, society, association, or person of a copy of such bye-laws, purporting to be signed by such chief secretary or under secretary, shall be sufficient proof in all courts of justice and elsewhere that such bye-laws have been duly approved of by such secretary or under secretary.

Recovery and application of Fines.

24. [Provides that fines imposed by any such bye-law shall be recovered in a summary way before any justice, and be divided equally between the informer and the local authority.]

Powers conferred on Mortgagees.

25. Every mortgage under this act shall confer on the mortgagees all the rights, powers, and privileges conferred on mortgagees by part 2 of the act of the session of 23 and 24 Vict., c. 145, and may contain any other covenants and conditions as may be agreed upon.

Power to appoint a receiver in case of arrears being due.

26. [Enables the Court of Chancery on petition from Board of Works to appoint a receiver over the mortgagee, if interest or instalment of principal be unpaid 31 days.]

AN ACT TO PROVIDE BETTER DWELLINGS FOR ARTIZANS AND LABOURERS

31 & 32 VICT., CAP. 130

[31st July, 1868.]

Short title.

1. Short Title, "The Artisans and Labourers' Dwelling Act, 1868."

Application of Act.

2. This act shall apply only to the places named in the first column of Table (A.) in the first schedule annexed hereto; and "Local Authority," "Local Rate," and "Clerk of Local Authority" shall mean "the Bodies of Persons," "Rate," and "Officer" in that table in that behalf mentioned; and the said table shall be of the same force as if it were enacted in the body of this act: provided always, that this act shall not apply to any city, borough, town, or place that would otherwise be included within the said table, the population whereof does not, according to the census for the time being in force, amount to the number of ten thousand persons.

Interpretation of terms.

3. [Defines that the word "Street" includes any court, alley, street, square, or row of houses; "Premises," any dwelling-house or inhabited building, the site thereof, yard, its garden, outhouses, &c.; the expression "Owner," in addition to the definition given by the Lands Clauses Act, shall include all lessees or mortgagees of any premises required to be dealt with under this act, except persons holding or entitled to the rents and profits of such premises for a term of years, of which 21 years do not remain unexpired; "Person" shall include a body of persons corporate or unincorporate; "Quarter Sessions" shall in *Ireland* mean, in towns and boroughs where there are separate quarter sessions, the quarter sessions of said boroughs and towns, and in boroughs where there are no separate quarter sessions, the quarter sessions of the divisions of the courts in which such towns or boroughs shall be situate; "Officer of Health" shall mean and include any sanitary officer.

In all cases in which the name of a local authority, local court, magistrate, or officer having any local jurisdiction in respect of their or his office is referred to, without mention of the locality to which the jurisdiction extends, such reference is to be understood to indicate the local authority, local court, magistrate, or officer having jurisdiction in that place within which are situate the premises or other subject matter, or any part thereof, to which such reference applies.]

(Definitions in reference to England and Scotland omitted.)

["Borough"^a in *Ireland* shall mean any place for the time being subject to the act passed in the session of the 3rd and 4th Vic., c. 108, relating to sanitary officers, but rendered useless by Public Health Act, 1844.]

"Borough" in Ireland.

5. If in any place to which this act applies the officer of health find that any premises therein are in a condition or state dangerous to health so as to be unfit for human habitation, he shall report the same in manner hereinafter provided to the local authority.

Officer of Health to report as to condition of streets.

6. Every report made under this act by the officer of health shall be made in writing and delivered to the clerk of the local authority, and the local authority shall refer such report to a surveyor or engineer, who shall thereupon consider the report so furnished to him, and report to the local authority what is the cause of the evil so reported on, and the remedy thereof; and if such evil is occasioned by defects in any premises, whether the same can be remedied by structural alterations and improvements or otherwise, or whether such premises, or any and what part thereof, ought to be demolished.

Officer of Health to deliver copies of report to Clerk of Local Authority, who shall refer the same to a Surveyor, &c.

7. Upon receipt of the report of the surveyor and engineer the local authority shall cause copies of both the reports to be given to the owner, with notice of the time and place appointed by the local authority for the consideration thereof, and such owner shall be at liberty to attend and to state his objections (if any) to such reports, or either of them, including therein any objection that the necessary works ought to be done by or at the expense of some other person or persons, or at the expense of the parish or district in which the premises are situate; and on such objections the local authority shall make an order in writing, signed by the clerk of such local authority, which shall be subject to appeal in manner hereinafter mentioned; and if such objections are over-ruled, the local authority, if they deem it necessary, shall cause to be prepared a plan and specification of the works (if any), and an estimate of the cost of such works required to be executed.

Local Authority to cause copies of reports to be given to Owner who may object to the same, and to prepare plan and specification of required works.

8. The clerk of the local authority shall thereupon forthwith give notice to the owner of the premises, informing him that a plan and specification and estimate of the cost of such works as are required in reference thereto have been prepared, and that such plan and specification and estimate may, if such owner think fit, be inspected and transcribed by him or his agent at the office of the clerk of the local authority without charge; and any such owner may at any time within three weeks after the receipt of such notice state in writing to the clerk of the local authority any objection which he may entertain to the said plan, specification, and estimate, or any of them, and may attend at a time and place to be appointed for such purpose by the local authority to support such objections; and the local authority shall thereupon make such order in relation thereto as they may think fit; and if they decide that any alteration is to be made in the said plan, specification, and estimate, the local authority shall cause such alteration to be made accordingly, and the plan and specification and estimate recommended shall be the plan and specification and estimate according to which the works shall be executed.

Clerk of Local Authority to give notice to Owner of plan, &c., of required works having been prepared.

^a In reference to this section, see Vict. 37 and 38, c. 93, s. 3.

Persons
aggrieved by
Order of Local
Authority may
appeal against
the same.

9. Any person aggrieved by any order of the local authority, or his agent, may appeal against the same to the court of quarter sessions held next after the making of the said order, but the appellant shall not be heard in support of the appeal unless, within one calendar month after the making of the order appealed against, he give to the clerk of the local authority notice in writing stating his intention to appeal, together with a statement in writing of the grounds of appeal, and shall, within two days after giving such notice, enter into a recognizance before some justice of the peace, with sufficient securities, conditioned to try such appeal at the said court and to abide the order of and pay such costs as may be awarded by the court or any adjournment thereof; and the court upon the appearing of the parties, or upon their making default, shall have full power and jurisdiction to make such order and give such directions as under the circumstances shall seem just, and may, according to its discretion, award such costs to the party appealing or appealed against as they think proper, and the determination of the court in or concerning the premises shall be conclusive and binding on all persons to all intents or purposes whatsoever:—Provided—

First, that if there be not time to give such notice and enter into such recognizance as aforesaid, then such appeal may be made to, and such notice, statement, and recognizance be given and entered into, for the next sessions at which the appeal can be heard: Secondly, that on the hearing of the appeal, no grounds of appeal shall be gone into or entertained other than those set forth in such statement as aforesaid: Thirdly, that in any case of appeal the Court shall, at the request of either party, state the facts specially for the determination, in *England* or *Ireland*, of her Majesty's Court of Queen's Bench, or in *Scotland* of either division of the Court of Session, in which case it shall be lawful to remove the proceedings, by writ of certiorari or by petition, into the said Courts of Queen's Bench or to the Court of Session respectively: Fourthly, that pending any appeal no work shall be done nor proceedings taken under any order until after the determination of such appeal, or it shall cease to be prosecuted.

Owner may
appeal where
decision of Local
Authority is
against him.

10. If the owner appeal from the decision of the local authority upon the objection that he is not responsible for the state and condition of his premises, he shall be bound to give notice of his appeal, and a statement in writing of the ground thereof, to the person or persons, or to the parish or district, alleged by him to be the occasion of his premises being in such a state or condition as to render them liable to be reported upon under the provisions of the act, and such person or persons, or parish or district, may appear before the Court, and be heard against his or their alleged liability.

Where Local
Authority
decide in favour
of Owner,
reports and
notices to be
sent to parties
liable.

11. If the local authority shall decide in favour of the objection of the owner of the premises that some other person or persons, or that the parish or district in which the premises are situate, is or are responsible for the state and condition of his premises, the local authority shall forthwith send copies of the reports of the officer of health and of the surveyor or engineer to such person or persons, or to the officer of such parish or district, together with notice of his or their alleged liability, and shall appoint a time and place for hearing the parties so alleged to be liable, and give notice thereof to the said parties, and also to the owner of the premises, and the local authority shall make such order thereupon as to them shall seem just, and the same shall be subject to appeal in manner aforesaid.

On representa-
tion by House-
holders that
disease exists
in any house,
Officer of Health
to inspect and
report.

12. If and whenever any four or more householders living in or near to any street by writing under their hands represent to the officer of health that in or near that street any premises are in a condition or state dangerous to health so as to be unfit for human habitation, he shall forthwith inspect the premises, and report thereon; but the

absence of any such representation shall not excuse him from inspecting any premises, and reporting thereon.

13. In the event of the local authority declining or neglecting for the space of three calendar months after receiving such report to take any proceedings to put this act in force, the householders who signed such representation may address a memorial to the Secretary of State, stating the circumstances, and asking that an inquiry be made, and upon receipt of such memorial the said Secretary of State may direct the local authority to proceed under the provisions of the act, and such direction shall be binding on the local authority.

If Local Authority neglect to enforce Act Secretary of State may compel it to proceed.

14. Within three calendar months after the service on the owner of the order by the clerk of the local authority, or, in the case of appeal, within one calendar month after the order of quarter sessions, or, in the event of a further appeal, within one calendar month after the order of the court of final appeal, the persons so served with the order of the local authority shall each of them signify in writing to the clerk of the local authority whether he is willing to effect the works required to be executed; and where two or more persons shall so signify, the right of effecting the works shall be given first to the person whose ownership is first or earliest in title.

Owner to signify to Clerk of Local Authority whether he is willing to execute specified works.

15. Where the owner of the premises and his residence or place of business are known to the local authority, it shall be the duty of the clerk of the local authority, if the owner be residing or have a place of business within the district of such local authority, to give any notice by this act required to be served on him to the owner, or for him, to some inmate of his place of residence or business within the place; and if he be not residing within such district, or has no place of business therein, then to send the notice by post in a registered letter addressed to the owner at his place of residence or business: provided that the notice served upon the agent of the owner shall be deemed notice to the owner.

Service of notice on Owner whose name and residence are known.

16. Where the owner of the premises or his residence or place of business is not known to, or after diligent inquiry cannot be found by, the local authority, then the clerk of the local authority may serve the notice by leaving it, addressed to the owner, with some occupier of the premises, or if there be not an occupier, then by causing it to be put up on some conspicuous part of the premises.

Service of notice on Owner whose name or residence is not known.

17. Every notice required to be given by the clerk of the local authority by this act shall be in writing or print, or partly in writing and partly in print, and shall be signed by the clerk of the local authority or deputy appointed by him.

Notices to be signed by the Local Authority.

18. The owner on whom the local authority shall have imposed in the first instance the duty of executing the work shall, within two calendar months thereafter, commence the works as shown on the plan and described in the specification, and shall diligently proceed with and complete the same in conformity with the specification to the satisfaction of the surveyor or engineer appointed by the local authority; and if such owner shall fail therein, the local authority shall require the owner next in order as aforesaid to execute the said works, and in case of his default, shall require the remaining owners in their order as aforesaid; and if all such owners shall make default, the local authority shall, as the case may seem to them to require, either order the premises to be shut up or to be demolished, or may themselves execute the required works in conformity with the specification.

Local Authority to require Owners to execute works as in specification.

Proceedings of Local Authority in case Owners neglect.

19. Where the local authority themselves execute the works, they may apply to the court of quarter sessions having jurisdiction over the place of which they are the local authority for an order charging on the premises on which the works have been executed the amount of all costs, charges, and expenses that have been incurred by such authority in or about the execution of such works, including the

Provision in case Local Authority themselves execute the works.

costs of obtaining the order; and the court of quarter sessions, when satisfied of the amount so expended, shall make an order accordingly, charging on the premises the amount of such costs, charges, and expenses, together with interest at the rate of four pounds per cent. per annum, and such order shall be filed and recorded in manner herein-after mentioned, and thereupon the amount of principal and interest thereby secured shall be a charge on the house, bearing interest at four per centum, and having priority over all other estates, incumbrances, and interests whatsoever, and the local authority shall, for the purpose of obtaining satisfaction of the moneys so charged, or of any interest thereon, be deemed to be a mortgagee of an absolute estate in the house, and shall be invested with all the powers conferred on mortgagees by Part II. of the act of the session of the twenty-third and twenty-fourth years of the reign of her present Majesty, chapter one hundred and forty-five, and in *Scotland* such order shall be recorded in the appropriate register of sasines.

Local Authority
to pay compensation when
total demolition
required.

20. If the requirements of the order involve the total demolition and not the improvement of the premises specified therein, the owner shall, within three months after service of the order, proceed to take down and remove the premises, and if such owner fail therein, then the local authority shall proceed to take down and remove the same; and the local authority shall sell the materials, and, after deducting the expenses incident to such taking down and removal, pay over the balance of moneys, if any, to the owner.

Determination
of Tenancies.

21. Where at the time of making the order the premises specified therein, or any part thereof, are or is subject to any tenancy from year to year, or for a year or for any less term, the local authority shall give notice to every such tenant, stating the time at which such tenancy will be determined.

Remedies of
Owner for
Breach of
Covenant, &c.,
not to be
prejudiced.

22. Provided always, that nothing in this act contained shall prejudice or interfere with the rights or remedies of any owner for the breach, non-observance, or non-performance of any covenant or contract entered into by a tenant or lessee in reference to any premises in respect of which any order shall be made by a local authority; and if any owner shall be obliged to take possession of any premises in order to comply with any order made under the provisions of this act, such entry or taking possession shall not affect his right to avail himself of any such breach, non-observance, or non-performance that may have occurred prior to his so taking possession.

Owner instead
of effecting
improvements
may take down
premises.

23. If the order be that the premises require improvement, the owner, including therein the owner of the first estate of inheritance, if he think fit, may, instead of effecting the works required by the plan and specification, take down the premises; but in every such case, and also in the event of the owner desiring to retain the site of the premises required by the order to be totally demolished, no house or other building or erection shall be erected on all or any part of the site of the premises so taken down which shall be injurious to health; and the local authority may at any time make an order upon the owner to abate or alter the said house, building, or erection, as the case may require; and in the event of non-compliance with such order the local authority may, at the expense of the owner thereof, abate or alter any house or other building or erection at any time, wholly or partly erected contrary to the provisions of this section.

Application may
be made to
Justices where
more than one
owner of
Premises
included in
order under
Act, and any
one Owner

24. When there are two or more owners of any premises, and it appears to any two justices in petty sessions, on application of any owner of such premises, that the interest of the applicant in the premises will be prejudiced by the neglect and default of any other owner to deal with the premises in conformity with the order so made, it shall be lawful for such justices, if the applicant undertake to their satisfaction to bring the premises into conformity with such order, to make an order empowering the applicant forthwith to take possession

of the premises, and to do all such works as may be necessary for bringing the same into conformity with such order, and within such time as shall be fixed by such justices, and on non-compliance by such last-mentioned applicant with his undertaking it shall be lawful for the justices to make a like order in favour of any other owner.

25. Where any owner has completed any works required to be executed by a local authority in pursuance of this act, he may on the completion thereof apply to the local authority for a charging order charging on the premises on which the works have been executed an annuity as compensation to the owner for the expenditure incurred by him in executing such works, and shall produce to the local authority the certificate of their surveyor or engineer that the works have been executed to his satisfaction, and also the accounts and vouchers for such works; and the local authority, when satisfied that the owner has duly executed such works, shall make a charging order accordingly.

The annuity charged shall be a sum of six pounds for every £100 of such expenditure, and so in proportion for any less sum, to commence from the date of the order, and to be payable for a term of thirty years to the owner named in such order, his executors, administrators, or assigns.

Charging orders made under this act shall be made according to the form marked A in the second schedule hereto annexed, or as near thereto as the circumstances of the case will admit.

The costs of obtaining the order to be allowed by the Local Authority shall be deemed to be part of the expenditure incurred by the owner.

26. Every annuity created by a charging order under this act shall be a charge on the premises comprised in the order, having priority over all existing and future estates, interests, and incumbrances, with the exception of quit rents and other charges incident to tenure, tithe commutation rent charges, and any charges created under any act authorizing advances of public money; and where more annuities than one are chargeable under this act on any premises, such annuities shall, as between themselves, take order according to their respective dates.

27. Every annuity charged on any premises by a charging order under this act may be recovered by the persons for the time being entitled to the same by the same means and in the like manner in all respects as if it were a rent charge granted by deed out of the premises by the owner thereof.

28. An order made in pursuance of this act charging an annuity on any premises shall be, both at law and in equity, conclusive evidence that all notices, acts, and proceedings by this act directed with reference to or consequent on the obtaining such order, or the making such charge, have been duly served, done, and taken, and that such charge has been duly created, and that it is a valid charge on the premises declared to be subject thereto.

29. [Refers only to Yorkshire and Middlesex.]

30. The proprietor of any charge may, by deed under seal, stamped with the same *ad valorem* stamp as if it were an assignment of a charge created by deed, assign the benefit of the charging order, or of any portion of the charge comprised therein, to any other person; and on such assignment being executed the assignee shall have the same rights under the order as the proprietor would have had if no such assignment had been executed; and any assignee of a charging order may, by deed stamped in manner aforesaid, assign the charge to any other person. Any assignment of a charging order may be in the form marked B in the schedule hereto, or in any other convenient form.

31. All expenses incurred by the local authority in pursuance of

neglects to
comply with
such order.

Grant of
Annuity to
owner on com-
pletion of
works.

Incidence of
Charge.

Charges
recoverable as
rent-charges
in lieu of tithes.

An order to be
evidence of
compliance
with Act.

Assignment
of Charge.

As to expenses
of local
authority.

this act shall be defrayed by them out of a special local rate, not exceeding twopence in the pound in any year, which they are hereby empowered to assess and levy for the purposes of this act.

Power to Public
Works Loan
Commissioners
to advance
monies to Local
Authority.

32. The Public Works Loan Commissioners, as defined by the Public Works Loan Act, 1853, may, if they think fit, lend to any local authority, and any local authority may borrow from the said commissioners, such sums as the said authority may require for the purposes of this act, but the amount of every loan shall be sanctioned by the Lords Commissioners of the Treasury.

Service of
Notice on
the Local
Authority.

33. Any summons, notice, writ, or other proceeding at law or in equity, or otherwise, in relation to carrying into effect the objects and purposes of this act, required to be served upon the local authority, may be lawfully served by delivering the same to the clerk of the local authority, or leaving the same at his office with some person employed there by him.

Notices served
by Local
Authority to be
signed by the
Clerk.

34. Any notice, demand, or other written document served by the local authority for the purposes of this act shall be signed by the clerk of the local authority.

Penalty for
obstructing
Officer of
Health, &c., in
execution of
Act.
Penalty for
preventing
execution of
Act.

35. Where any person at any time obstructs the officer of health or other person acting in the performance of anything which the local authority or their officers respectively are by this act required or authorized to do, every person so offending shall for every such offence forfeit not exceeding twenty pounds.

36. If the occupier of any premises prevents the owner thereof, or if the owner or occupier of any premises prevents the officer of health, or their officers, agents, servants, or workmen, from carrying into effect with respect to the premises any of the provisions of this act, after notice of the intention so to do has been given to the occupier, or, as the case shall be, to the owner, any justice on proof thereof may make an order in writing requiring the occupier to permit the owner, or, as the case shall be, requiring the owner or occupier, or both, to permit the officer of health, or the local authority, and their officers, agents, servants, and workmen, to do all things requisite for carrying into effect with respect to the premises the provisions of this act; and if at the expiration of ten days after the service of such order of the justice the occupier or owner fails to comply therewith, every person so offending shall for every day during which the failure continues forfeit not exceeding twenty pounds: provided that during any such failure by the occupier, the owner, unless assenting thereto, shall not be liable to the forfeiture.

Appearance of
Local Authority.

37. The local authority may appear before any judge, justices, borough magistrates, sheriff, or sheriff substitute, by their clerk, and any company or body corporate may appear before the said magistrate or magistrates by any member of their board of management.

Recovery of
Penalties.

38. Penalties under this act may be recovered before two justices in manner directed by an act passed in the session holden in the eleventh and twelfth years of the reign of her Majesty Queen Victoria, chapter forty-three, intituled *An Act to facilitate the Performance of the Duties of Justices of the Peace out of Sessions within England and Wales with respect to summary Convictions and Orders*, or any act amending the same, and in Scotland by summary complaint before the sheriff, sheriff substitute, or two justices, or in boroughs before the magistrates, in manner provided by "The Summary Procedure Act, 1864," and in Ireland in manner directed by "The Petty Sessions (Ireland) Act, 1851," and any act amending the same.

39. [Refers to Scotland.]

Application of
Act to Ireland

40. For the purpose of adapting this act to Ireland the words "The Lands Clauses Consolidation Act, 1845," shall mean "The Railways Act, Ireland, 1851," and the several acts amending the same.

41. Any act, power, or jurisdiction hereby authorised to be done or exercised by two justices may be done or exercised by the following

magistrates within their respective jurisdictions—that is to say, Jurisdiction of
 * * * * * as to *Ireland*, by any one or more divisional certain Magis-
 magistrates of police in the police district of *Dublin*, and elsewhere by trates,
 two or more justices of the peace in petty sessions.

IRELAND. *a*

Places to which Act applies.	Description of Local Authority.	Description of Local Rate.	Description of Clerk of Local Authority.
The City of Dublin.	The Right Honourable the Lord Mayor, aldermen, and burgesses, acting by the Council.	The borough fund or borough or improvement rate.	The town clerk.
Towns Corporate or Boroughs (with the exception of the city of Dublin).	The mayor, aldermen, and burgesses, acting by the council.	The borough fund, or town fund, or borough rate.	The town clerk.
Towns having town commissioners under 9 G. 4, c. 82, or 17 & 18 Vict., c. 103, or any acts amending the same, or having commissioners or other governing body under any local act.	The town commissioners or other governing body.	Any rate lovable by these bodies, or any fund belonging to them applicable in the whole or in part to the making or repairing of sewers within their jurisdiction.	The clerk of the commissioners or other governing body.

a Authorities in England and Scotland omitted.

SECOND SCHEDULE.

FORM MARKED A.

The Artisans and Labourers Dwellings Act, 1868.

County of
 Parish of
 No.

Charging Order.

The _____ being the local authority under _____ Insert descrip-
 the above-mentioned act, do, by this order under their hands and seal, tion of Local
 charge the inheritance or fee of the premises mentioned in the schedule Authority.
 hereto with the payment to
 of the sum of _____ pounds, payable yearly on
 the _____ day of _____ for the term of
 _____ years, and being in consideration of an
 expenditure of _____ pounds incurred by him in respect of
 the said premises.

SCHEDULE.

FORM MARKED B.

Form of Assignment of Charge.
To be endorsed on Charging Order.

Insert descrip-
 tion of premises
 charged.

Dated the _____ day of _____, in
 I, the within-named _____, in
 pursuance of the Artisans and Labourers Dwellings Act, 1868, and
 in consideration of _____ pounds this day paid to me,
 hereby assign to _____ the within-
 mentioned charge.

(Signed)

AN ACT TO AMEND "THE LABOURING CLASSES
DWELLINGS ACTS, 1866."

30 VICT., CAP. 28.

[17th June, 1867.]

- Short title. 1. (Short title, "The Labouring Classes Dwelling Houses Act, 1867.")
- Defining meaning of certain terms in 29 and 30 Vict., cc. 28 and 44. 2. In the fourth section of "The Labouring Classes Dwelling Houses Act, 1866," the words "land or dwellings for the purposes of which the advance is made," and in the twelfth section of "The Labouring Classes Lodging Houses and Dwellings Act (*Ireland*), 1866," the words "lands, buildings, or premises for the purpose of which such advance shall be made," shall respectively be construed to include any land, buildings, or premises held together with and for the same estate and interest as the lands, buildings, or premises upon which the money advanced is to be expended under the provisions of the said acts respectively.
- In case of advances to company part of whose capital is unpaid, loan commissioners may dispense with mortgage. 3. In the case of an advance under the provisions of either of the said acts to a company or society, any part of whose capital remains uncalled up or unpaid, it shall be lawful in *Ireland* for the Public Works Commissioners to dispense with a mortgage of such capital remaining uncalled up or unpaid, or of such part thereof as they may think fit.
4. [Refers to Scotland.]

AN ACT TO AFFORD FACILITIES FOR THE ESTABLISHMENT AND MAINTENANCE OF PUBLIC PARKS IN IRELAND. (APPLIES TO IRELAND ONLY.)

32 & 33 VICT., CAP. 28.

[12th July, 1869.]

- Part of 8 and 9 Vict., c. 18, incorporated. Interpretation of terms. 3. The provisions of the Lands Clauses Consolidation Act, 1845, for the purchase of lands by agreement, are incorporated with this act.
4. The expression "governing body" shall in the several places in the schedule annexed hereto in that behalf mentioned mean the persons or bodies of persons referred to in the first column of the schedule hereto annexed; and the term "town" in relation to a governing body shall as respects each authority mean the places in that behalf referred to in the second column of the said schedule.
5. The governing body of any town, the population of which, according to the last account from time to time taken thereof by the authority of Parliament, exceeds six thousand persons, may, by a resolution to be made in manner hereinafter mentioned, determine to establish and maintain any public park or parks for the use and enjoyment of the persons inhabiting such town, and may, after the said resolution has been confirmed, levy rates for making or maintaining such public park or parks, and may, for the purposes of this act, purchase lands, and may accept gifts or grants of land.
- Governing body may determine to establish public parks, walks, &c., and levy rates for maintaining the same, &c.

6. Any resolution by the governing body of any town for the purposes aforesaid shall not have effect unless the same has been agreed to by the governing body in some meeting whereof special notice has been given, and has been confirmed in a subsequent meeting held not sooner than four weeks after the next ensuing annual election of the members of the governing body, and which subsequent meeting has been advertised once at least in each of the four weeks immediately preceding the said meeting in some newspaper circulated within the limits of the town, and of which special notice in writing has been given to each member of the governing body. Resolution.

7. The governing body of any town shall pay all expenses incurred by them in carrying any resolution under this act into effect out of the fund in the schedule in that behalf mentioned, and, where such fund arises wholly or in part from rates, shall have, in addition to their existing powers of rating, all such powers for making and levying any extra rate, if necessary, respectively, as in the case of any rate authorised to be made under the provisions of the respective acts of Parliament under which such governing body is constituted or authorised to levy rates; and all provisions of such acts respectively shall be applicable in respect thereof: provided that when the rates to be assessed by such governing body are limited by law to a certain rateable amount, such limitation shall not apply or extend to expenses incurred in carrying this act into execution; and it shall be lawful for such governing body to assess the expenses under this act, in addition to such limited assessment: provided always, that no rate made in any one year under the authority of this act shall exceed threepence in the pound. How expenses to be defrayed.

8. The governing body of any town shall, for the purposes of this act, have all such powers of borrowing money on the security of the rate or fund available for the payment of expenses under this act as are vested in such governing body under the provisions of the respective acts of Parliament under which such governing body is constituted or authorized to levy rates; but such powers shall be subject to the conditions and sanction (if any) under which the powers under the said acts may be exercised by such governing bodies: provided always, that the powers of borrowing money hereby conferred may be exercised in addition to the powers conferred by the said acts. Power to borrow money.

9. Where any resolution to establish and maintain a park in any town under the provisions of this act has been confirmed, the governing body of such town may from time to time, at any meeting specially convened for that purpose, form a committee, consisting wholly of its own members, or partly of its own members and partly of such other persons contributing to the rate or fund out of which the expenses incurred in carrying out this act are to be paid, and qualified in such manner as the governing body may determine; and the governing body may define the powers of such committee, and may delegate to them all or any of the powers of such governing body under this act. Power to appoint committees.

10. Where any park shall have been established in any town under the provisions of this act, the governing body of such town may make bye-laws for the use, government, control, or management of such park, and for the protection and preservation from injury of the same, and of the trees, shrubs, walks, seats, gates, fences, and palings, and all other parts thereof, and for the exclusion of improper persons from the same, and may alter or revoke any such bye-laws, and shall appoint a penalty not exceeding five pounds for any and every breach of any bye-law made as aforesaid: provided always, that such bye-laws shall be made by such governing body in the same manner, subject to the same conditions, and with the like sanction, as if the same were bye-laws made by such governing body under the provisions of and for the purposes mentioned in the act or acts under which such governing body is constituted or authorized to levy rates. Power to make bye-laws.

[The towns referred to in this act are—Dublin ; towns corporate ; towns having town commissioners under the Towns Improvement (Ireland) Act, 1854, 17 & 18 Vict., c. 113, or under any local act, and townships having commissioners under local acts ; and towns under 3 & 4 Vict., c. 108.]

AN ACT TO FACILITATE IN CERTAIN CASES THE
OBTAINING OF POWERS FOR THE CONSTRUCTION OF
GAS AND WATER WORKS AND FOR THE SUPPLY OF
GAS AND WATER.

33 & 34 VIC., CAP. 70.

[9th August, 1870.]

Preliminary.

Short title

1. This act may be cited for all purposes as “The Gas and Water Works Facilities Act, 1870.”

Interpretation
of terms.

2. For the purposes of this act the terms hereinafter mentioned shall have the meanings hereinafter assigned to them ; that is to say,
The term “local authority” shall mean the bodies of persons named in the table in the schedule (A.) to this act annexed :

The term “road” shall mean any carriage way being a public highway, and any bridge forming part of the same :

The term “road authority” shall mean any local authority, board, town council, body corporate, commissioners, trustees, vestry, or other body or persons, in whom a road as defined by this act is vested, or who have the power to maintain or repair such road :

The term “district,” in relation to a local authority, shall mean the area within the jurisdiction of such local authority :

The term “The Lands Clauses Acts” means, so far as the provisional order in which that term is used relates to England or Ireland, the Lands Clauses Consolidation Act, 1845 ; and, so far as the same relates to Scotland, the Lands Clauses Consolidation (Scotland) Act, 1845 ; together with, in each case, the Lands Clauses Consolidation Acts Amendment Act, 1860.

Description of Cases within this Act.

Act to apply to
certain cases

3. This act shall apply where powers are required for all or any of the purposes following :—

(1.) To construct or to maintain and continue gasworks and works connected therewith, or to manufacture and supply gas in any district within which there is not an existing company, corporation, body of commissioners, or person empowered by act of parliament to construct such works or to manufacture and supply gas.

- (2.) To construct or to maintain and continue waterworks and works connected therewith, or to supply water in any district within which there is not an existing company, corporation, body of commissioners, or person empowered by act of parliament to construct such works and to supply water.
- (3.) To raise additional capital necessary for any of the purposes aforesaid.
- (4.) To enable two or more companies or persons duly authorised to supply gas or water in any district or in adjoining districts to enter into agreements jointly to furnish such supply or to amalgamate their undertakings.
- (5.) To authorise two or more companies or persons supplying gas or water in any district or in adjoining districts to manufacture and supply gas or to supply water, and to enter into agreements jointly to furnish such supply and to amalgamate their undertakings.

And such purposes, or any one or more of them, as the case may be, shall, for the purposes of this act, be deemed to be included in the term "gas undertaking" or "water undertaking," according as the same relate to the supply of gas or water: provided that any gas or water company empowered as aforesaid may apply for and avail themselves of the facilities of this act within their own districts respectively.

Provisional Orders authorising Gas and Water Undertakings.

4. Provisional orders authorising any gas undertaking or water undertaking under the authority of this act may be obtained in any district by any company, companies, or person; and in the construction of this act the term "the undertakers" shall be deemed to include any such company, companies, or person.

By whom provisional orders authorising undertakings may be obtained.

Where the undertakers require powers for the purpose of constructing gasworks or waterworks, or works connected therewith, within any district, the consent of the local authority of such district shall be necessary before any provisional order can be obtained; and where in such district there is a road authority distinct from the local authority, the consent of such road authority shall also be necessary in any case where power is sought to break up any road of such road authority, before any provisional order can be obtained, unless the Board of Trade, in any case in which the consent of the local authority or road authority is refused, are of opinion, after inquiry, that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in such case they shall make a special report, stating the grounds upon which they have dispensed with such consent.

5. The undertakers intending to make an application for a provisional order in pursuance of this act shall proceed as follows:—

Notices and deposit of documents by promoters as in schedule.

- (1.) On or before the first of November next before their application they shall give notice in writing of their intention to make the same to every company, corporation, or person (if any) supplying gas (if the proposed application relates to gasworks) or water (if the proposed application relates to waterworks) within the district to which the proposed application refers.
- (2.) In the months of October and November next before their application, or in one of those months, they shall publish notice of their intention to make such application by advertisement, according to the regulations contained in part one of the schedule (B.) to this act; and where it is proposed to abstract water from any stream for any waterwork, they shall give notice in writing of their intention to make such application to the

owners or reputed owners, lessees or reputed lessees, and occupiers of all mills and manufactories or other works using the waters of such stream for a distance of twenty miles below the point at which such water is intended to be abstracted, such distance to be measured along the course of such stream, unless such waters shall within a less distance than twenty miles fall into or unite with any navigable stream, and then only to the owners or reputed owners, lessees or reputed lessees, and occupiers of such mills and manufactories as aforesaid which shall be situate between the point at which such water is proposed to be abstracted and the point at which such water shall fall into or unite with such navigable stream; and such notice shall state the name (if any) by which the stream is known at the point at which such water shall be immediately abstracted, and also the parish in which such point is situate, and the time and place of deposit of the plans and sections required by this act to be deposited.

(3.) On or before the thirtieth day of the same month of November they shall deposit the documents described in part two of the same schedule, according to the regulations therein contained.

(4.) On or before the twenty-third day of December in the same year they shall deposit the documents described in part three of the same schedule, according to the regulations therein contained.

All maps, plans, and documents required by this act to be deposited for the purposes of any provisional order may be deposited with the persons and in the manner directed by the act of the session of parliament held in the seventh year of the reign of his late Majesty King William the Fourth and the first year of her present Majesty, intituled "An act to compel clerks of the peace for counties and other persons to take the custody of such documents as shall be directed to be deposited with them under the standing orders of either house of parliament;" and all the provisions of that act shall apply accordingly.

Power for Board of Trade to determine on application and on objection.

Power for Board of Trade to make provisional order.

6. The Board of Trade shall consider the application, and also any objection thereto that may be lodged with them on or before such day as they from time to time appoint, and shall determine whether or not the undertakers may proceed with the application.

7. Where it appears to the Board of Trade expedient and proper that the application should be granted, with or without addition or modification, or subject or not to any restriction or condition, and it has been proved to their satisfaction that all the requisitions of section five of this act have been in all respects complied with, the Board of Trade may settle and make a provisional order accordingly.

Every such provisional order, if it relates to gas works, shall expressly restrict the undertakers from manufacturing gas or any residual products arising in the manufacture of gas on any land except such as is specified in that behalf in the order; and shall also expressly restrict them from storing gas on any land except such as is specified in that behalf in the order within three hundred yards from any dwelling-house existing at the time when the undertakers propose to store gas on such land, without the consent in writing of the owner, lessee, and occupier of such dwelling-house.

Form and contents of provisional order.

Every such provisional order shall contain such other provisions as, according to the nature of the application and the facts and circumstances of each case, the Board of Trade thinks fit to submit to parliament for confirmation, in manner provided by this act; but so that any such provisional order shall not contain any provision for empowering the undertakers or any other person to acquire lands otherwise than by agreement, or to acquire any lands, even by agreement, except to an extent therein limited.

The costs of and connected with the preparation and making of each provisional order shall be paid by the undertakers, and the Board of Trade may require the undertakers to give security for such costs before they proceed with the provisional order.

Costs of order.

8. When a provisional order has been made as aforesaid and delivered to the undertakers, the undertakers shall forthwith deposit and publish the same by advertisement, according to the regulations contained in part four of the schedule (B.) to this act.

Publication of provisional order as in schedule.

9. On proof to the satisfaction of the Board of Trade of the completion of such publication as aforesaid, the Board of Trade shall, as soon as they conveniently can after the expiration of seven days from the completion of such publication in relation to any provisional order which shall have been published as aforesaid, not later than the twenty-fifth of April in any year, procure a bill to be introduced into either house of parliament for an act to confirm the provisional order, which shall be set out at length in the schedule to the bill; but until confirmation by act of parliament, a provisional order under this act shall not have any operation.

Confirmation of provisional order by act of Parliament.

If while any such bill is pending in either house of parliament a petition is presented against any provisional order comprised therein, the bill, so far as it relates to the order petitioned against, may be referred to a select committee, and the petitioner shall be allowed to appear and oppose, as in the case of a bill for a special act.

The act of parliament confirming any provisional order under this act shall be deemed a public general act.

10. The provisions of the Lands Clauses Acts shall be incorporated with every provisional order under this act, save where the same are expressly varied or excepted by any such provisional order, and except as to the following provisions, namely:—

Incorporation of general acts in provisional order.

- (1.) With respect to the purchase and taking of lands otherwise than by agreement.
- (2.) With respect to the entry upon lands by the promoters of the undertaking.

Where a provisional order authorises a gas undertaking, the provisions of "The Gasworks Clauses Act, 1847," shall be incorporated with such provisional order, save where the same are thereby expressly varied or excepted.

Where a provisional order authorises a water undertaking, the provisions of "The Waterworks Clauses Act, 1847," and of "The Waterworks Clauses Act, 1863," shall be incorporated with such provisional order, save where the same are thereby expressly varied or excepted.

For the purposes of such incorporation a provisional order under this act shall be deemed the special act.

11. If any undertakers empowered by any provisional order under this act to make works do not, within three years from the date of such provisional order, or within any shorter period prescribed therein, complete the works; or,

Cesser of powers at expiration of prescribed time.

If within one year from the date of the provisional order, or within such shorter time as is prescribed in the provisional order, the works are not substantially commenced; or,

If the works are commenced, but whilst the powers to carry them on exist are suspended without a reason sufficient in the opinion of the Board of Trade to warrant such suspension;

the powers given by the provisional order to the undertakers for executing such works, or otherwise in relation thereto, shall cease to be exercised, except as to so much of the same as is then completed, unless the time be prolonged by the special direction of the Board of Trade.

A statement in writing by the Board of Trade to the effect that such works have not been completed, or that the works have not been substantially commenced, or that they have been suspended without

Gas rents and water rates in schedule.

Company not exempt from provisions of general act.

Queen in Council may substitute any department for Board of Trade for the purposes of this act.

sufficient reason, shall be conclusive evidence for the purposes of this section of such non-completion, non-commencement, or suspension.

12. The undertakers empowered by any provisional order under this act may demand and take, in respect of gas or water supplied by them under the authority of such provisional order, rents and rates respectively not exceeding the sums specified in such provisional order, subject and according to the regulations therein specified.

13. Nothing in any provisional order, or act confirming the same, shall exempt the undertaking, or the company, corporation, or person to whom it belongs from the provisions of any general act of parliament relating to gasworks or waterworks passed after the passing of this act, or from any revision or alteration under the authority of parliament of the maximum rents and rates allowed to be taken under the provisional order.

14. For the purpose of carrying into effect the provisions of this act, it shall be lawful for her Majesty at any time after the passing of this act, by order in Council, to substitute for the Board of Trade any other department of her Majesty's government, and from and after such time as may be specified for the purpose in any such order, or if no time be specified therein, from and after the date of such order, all matters to be done in pursuance of this act by or in connexion with the Board of Trade shall be done by or in connexion with such substituted department.

[The last section exempts London district.]

SCHEDULE A.

Districts of Local Authorities.	Description of Local Authority of District set opposite its Name.
<i>Ireland.</i>	
The city of Dublin	The Right Honourable the Lord Mayor, aldermen, and burgesses, acting by the Town Council.
Towns corporate, with exception of Dublin.	The mayor, aldermen, and burgesses, acting by the town council.
Towns having commissioners under an act made in the 9th year of the reign of George the Fourth, intituled "An act to make provision for the lighting, cleansing, and watching of cities and towns corporate and market towns in Ireland in certain cases."	The commissioners.
Towns having municipal commissioners under 3 and 4 Vict., c. 108.	The municipal commissioners.
Towns having town commissioners under the Towns Improvement (Ireland) Act, 1854 (17 and 18 Vict., c. 103), or any acts amending the same, or under any local act.	The town commissioners.
Townships having commissioners under local acts.	The township commissioners.

SCHEDULE.

a PROVISIONAL ORDERS.*Advertisement in October or November of intended application.*

(1) Every advertisement is to contain the following particulars :

1. The objects of the intended application.
2. A general description of the nature of the proposed new works, if any.
3. The names of the townlands, parishes, townships, and extra-parochial places in which the proposed new works, if any, will be made.
4. The times and places at which the deposit under Part II. of this schedule will be made.
5. An office, either in London or at the place to which the intended application relates, at which printed copies of the draft Provisional Order, when deposited, and of the Provisional Order, when made, will be obtainable as hereinafter provided.

(2.) The whole notice is to be included in one advertisement, which is to be headed with a short title descriptive of the undertaking.

(3.) The advertisement is to be inserted once at least in each of two successive weeks in some one and the same newspaper published in the district affected by the proposed undertaking, where the proposed works (if any) will be made ; or if there be no such newspaper, then in some one and the same newspaper published in the county in which every such district, or some part thereof, is situate ; or if there be none, then in some one and the same newspaper published in some adjoining or neighbouring county.

(4.) The advertisement is also, in every case, to be inserted once at least in the * * * *Dublin Gazette.* * *

Deposit on or before 30th November.

(1.) The undertakers are to deposit—

1. A copy of the advertisement published by them.
2. If the application relates to gas, a map showing the land proposed to be used for the manufacture of gas, or of residual products arising in the manufacture of gas.
3. A proper plan and section of the proposed new works, if any. Such plan and section to be prepared according to such regulations as may from time to time be made by the Board of Trade in that behalf.

(2.) The documents aforesaid are to be deposited for public inspection—

In Ireland, in the office of the clerk of the peace for every county, riding, or division.

(3.) The documents aforesaid are also to be deposited at the office of the Board of Trade.

Deposit on or before 23rd December.

(1.) The undertakers are to deposit at the office of the Board of Trade—

1. A memorial signed by the undertakers, headed with a short title descriptive of the undertaking (corresponding with that at the head of the advertisement), addressed to the Board of Trade, and praying for a Provisional Order.
2. A printed draft of the Provisional Order as proposed by the undertakers, with any schedule referred to therein.

a May be given in September. See 4th sec. of Local Government (Ireland) Act, and 30th sec. Public Health Act, 1874.

3. An estimate of the expense of the proposed new works, if any, signed by the persons making the same.

(2.) They are also to deposit a sufficient number of such printed copies at the office named in that behalf in the advertisement; such copies to be there furnished to all persons applying for them at the price of not more than one shilling each.

(3.) The memorial of the undertakers (to be written on foolscap paper, bookwise, with quarter margin) is to be in the following form, with such variations as circumstances require :—

[*Short title of undertaking.*]

To the Board of Trade,

The memorial of the undertakers of [*short title of undertaking*] :
Sheweth as follows :

1. Your memorialists have published, in accordance with the requirements of the Gas and Water Works Facilities Act, 1870, the following advertisement :

[*Here advertisement to be set out verbatim.*]

2. Your memorialists have also deposited, in accordance with the requirements of the said act, copies of the said advertisement and [*Here state deposit of the several matters required by Act*].

Your memorialists, therefore, pray that a Provisional Order may be made in the terms of the draft proposed by your memorialists, or in such other terms as may seem meet.

A. B.,

C. D.,

Undertakers.

Deposit and advertisement of Provisional Order when made.

(1.) The undertakers are to deposit printed copies of the Provisional Order, when settled and made, for public inspection in the offices of clerks of the peace and sheriff clerks, where the documents required to be deposited by them under Part II. of this schedule were deposited.

(2.) They are also to deposit a sufficient number of such printed copies at the office named in that behalf in the advertisement; such copies to be there furnished to all persons applying for them at the price of each.

(3.) They are also to publish the Provisional Order as an advertisement once in the local newspaper in which the original advertisement of the intended application was published.

THE GAS AND WATER WORKS FACILITIES ACT (1870)
AMENDMENT ACT, 1873.

35 & 37 VIC. CAP. 89.

[Relates exclusively to gas.]

SANITARY LOANS ACT, 1869.

32 & 33 VICT. CAP. 100.

An Act to facilitate the borrowing Money in certain cases for the purpose of "The Sanitary Act, 1866," and the acts amending the same; and for other purposes.

[11th August, 1869.]

Whereas by "The Sanitary Act, 1866," "The Sewage Utilization Act, 1867," and "The Sanitary Act, 1868," one of her Majesty's Principal Secretaries of State *a* is empowered, in case of any sewer authority, local board, or nuisance authority making default in performing their duty in relation to the sanitary matters therein mentioned, to appoint a person to perform the same, and it is by the said acts provided that the person so appointed should be invested in the performance of his duties with all the powers of the authority in default, and that the expenses of the performance of such duties shall be a debt due from the authority in default and repayable out of any local rate leviable by them:

And whereas it is expedient to give further facilities to the said Secretary of State in carrying into effect the provisions of the said act:

Be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. This act may be cited as "The Sanitary Loans Act, 1869."
2. This act shall not extend to *Scotland* or *Ireland*. *b*
3. "Sewer Authority," "Local Board," and "Nuisance Authority" shall have the same meaning as they respectively have in "The Sanitary Act, 1868," and "Local Authority" shall include all the said authorities.

Short title.
Application of
act.
Definition of
"Local Authority."

"Local rate" shall have the same meaning as it has in the eighth section of the "Sanitary Act, 1868."

4. One of her Majesty's Principal Secretaries of State *a* may, from time to time, certify under his hand the amount of expense that has been incurred, or an estimate of the expenses about to be incurred, by any person appointed by the Secretary of State for the purpose of performing the duty of a defaulting local authority; he may also, from time to time, certify under his hand the amount of any loan required to be raised for the purpose of defraying any expense that may have been so incurred, or is estimated as about to be incurred; and the certificate of the said Secretary of State shall be conclusive as to the matters to which it refers.

Certificate of
Secretary of
State as to
expenses and
loans.

5. Whenever the said Secretary of State *a* certifies any loan to be required for the purpose of defraying any expenses incurred or to be incurred in the performance of the duty of a defaulting local authority, the Public Works Loan Commissioners, as defined for the purposes of "The Public Works Loan Act, 1853," may, in manner and subject to the provisions of the said act, and the other enactments relating to the said commissioners and applicable to the case, advance to the said Secretary of State *a* or to any person appointed by him as aforesaid,

Power of
Secretary of
State to borrow
money for
sanitary pur-
poses.

a The powers of the Secretary of State under this act are by the 23rd sec. of The Local Government (Ireland) Act vested in the Lord Lieutenant, and are transferred from him to Irish Local Government Board by Public Health Act, 1874.

b Extended to Ireland by the 33rd sec. of "The Local Government (Ireland) Act."

the amount of the loan so certified to be required, on the security of the local rate, without requiring any other security; and the said Secretary of State,^a or the person so appointed as aforesaid, may, by any instrument under his hand, charge the local rate with the repayment of the principal and interest due in respect of such loan, and any such charge shall have the same effect as if the defaulting local authority were empowered to raise such loan on the security of the local rate, and had duly executed an instrument charging the same upon the local rate; and the certificate of the Secretary of State^a certifying any loan to be required, or appointing a person to perform the duty of a defaulting local authority, shall be taken as conclusive evidence that all the requirements of the forty-ninth section of "The Sanitary Act, 1866," and of any other enactment relating thereto, have been duly complied with, and that the person appointed to perform the duty of the defaulting local authority has been duly appointed.

Remedy for
principal and
interest.

6. Any principal money or interest for the time being due in respect of any loan under this act made for payment of the expenses incurred or to be incurred in the performance of the duty of a defaulting local authority shall be taken to be a debt due from such authority, and, in addition to any other remedies, may be enforced in the manner in which a debt due from a defaulting authority may be enforced in pursuance of the said eighth section of "The Sanitary Act, 1868."

Application of
surplus of loan.

7. If the amount of any loan raised for defraying the expenses incurred or to be incurred in the performance of the duty of a defaulting local authority is not wholly expended in defraying such expenses, the overplus (if any), the amount to be ascertained by a certificate of the Secretary of State,^a shall be paid to or to the order of the defaulting authority.

Secretary of
State may
change person
performing
duties of Local
Authority.
Power of
Secretary to
order payments.

8. The said Secretary of State^a may, from time to time, by order under his hand, change the person appointed by him to perform the duty of a defaulting local authority.

9. The Secretary of State^a may make order for the payment of the costs of all inquiries or proceedings directed by him in pursuance of "The Local Government Act, 1858," the Sanitary Acts, 1866, 1868, the Sewage Utilization Acts, 1865, 1867, or any of such acts, and as to the parties by whom or the rates out of which such costs shall be borne and such orders may be enforced in the same way as orders for costs of appeals under the eighty-first section of "The Local Government Act, 1858."

Definition of
expenses.

10. "Expenses" for the purposes of this act shall include all sums payable by or by the order of the Secretary of State,^a or the person appointed by him, on the occasion of a default being made by any local authority in the performance of its duties in relation to sanitary matters.

^a Now Local Government Board

AN ACT TO AMEND THE LAWS RELATING TO THE
BURIAL OF THE DEAD IN IRELAND.

19 & 20 VIC., CAP. 98.

[29th July, 1856.]

1. This act may be cited as "The Burial Grounds (*Ireland*) Act, 1856." Short title.

2. In this act the following words and expressions shall have the several meanings hereby assigned to them, unless there be something in the subject or context repugnant to such construction—that is to say, "Lord Lieutenant"^a shall mean the Lord Lieutenant of *Ireland* or other Chief Governor or Governors thereof; "Council" shall mean her Majesty's Privy Council in *Ireland*; "Borough" shall mean any borough or town corporate in *Ireland*, or any town in which a board of municipal commissioners shall have been elected under the provisions of an act of the third and fourth years of her present Majesty, chapter one hundred and eight, or in which town commissioners shall have been appointed under the provisions of an act of the ninth year of King *George* the Fourth, chapter eighty-two, or an act of the seventeenth and eighteenth years of her present Majesty, chapter one hundred and three, or any act amending the same; "Town Council" shall mean the town council of the borough, or where there is no town council, the board of municipal commissioners, or the town commissioners acting for the borough or town; "the Borough Fund" shall be held to include "the Town Fund;" "Parish" shall extend to any extra-parochial precinct or place; "Ratepayers" shall mean the persons for the time being assessed to and paying rates, or liable to be rated under the provisions of this act; "Town Clerk" shall mean the town clerk of the borough, or, where there is no town clerk, the clerk of the board of municipal commissioners, or of the town commissioners acting for the borough or town. Interpretation of terms.

3. In the execution of this act in poor law unions, or any portion thereof not within the limits or boundaries of any borough as defined by this act, "Burial Board" shall be held to signify the board of guardians for the relief of the poor within any such poor law union or portion thereof, and the manner of holding and transacting business at meetings of such burial boards shall be similar to the manner in use in respect of the relief of the poor; and within the limits or boundaries of any borough, the town council of the borough shall be held to be the burial board of such borough. Burial Boards to carry this act into execution.

4. The board of guardians for the relief of the poor shall, in carrying into execution the provisions of this act, be subject to the direction and control of the commissioners^b appointed for administering the law for the relief of the poor in *Ireland*. Board of Guardians to be subject to Poor Law Commissioners.

5. In case it shall appear to the Lord Lieutenant in Council, upon representation duly made to him, that for the protection of the public health the opening of any new burial ground in any city or town or within any other limits in *Ireland*, save with the approval of the Lord Lieutenant, ^b should be prohibited, or that burials in any city or town or within any other limits, or in any burial grounds or places of burial, On Representation duly made to him, Lord Lieutenant in Council may restrain the opening of new burial grounds, and order discontinuance of burials in specified places.

^a The Powers of the Lord Lieutenant and Privy Council have been transferred to the Local Government (*Ireland*) Board by 35 and 36 Vict., c. 69, and 37 & 38 Vic., c. 93.

^b Now Local Government Board. 35 & 36 Vict., c. 69.

should be wholly discontinued, or should be discontinued subject to any exception or qualification, it shall be lawful for the Lord Lieutenant,^a by and with the advice of her Majesty's Privy Council in *Ireland*, to order that no new burial ground shall be opened in any city or town, or within such limits, without such previous approval, or (as the case may require) that after a time mentioned in the order burials in such city or town or within such limits, or in such burial grounds or places of burial, shall be discontinued wholly, or subject to any exceptions or qualifications mentioned in such orders, and so from time to time as circumstances may require: provided always, that notice of such representation, and of the time when it shall please the Lord Lieutenant^a to order the same to be taken into consideration by the Privy Council, shall be published in the *Dublin Gazette*, and shall be affixed on the doors of the churches or chapels of or on some other conspicuous places within the parishes affected by such representation, one month before such representation is so considered.

Lord Lieutenant in Council may postpone order for discontinuance of burials, &c.

6. It shall be lawful for the Lord Lieutenant^a by and with the advice of the Privy Council, ^a to postpone the time appointed by any order in Council for the discontinuance of burials, or otherwise to vary any order in Council made under this act (whether the time thereby appointed for the discontinuance of burials thereunder or other operation of such order shall or shall not have arrived) as to the Lord Lieutenant^a in Council shall seem fit; and every order of the Lord Lieutenant^a in Council made for varying any order previously made under this act shall be deemed valid and effectual in law.

Order not to extend to burial grounds of Quakers unless expressly included.

7. No such order in Council as aforesaid shall be deemed to extend to any burial ground of the people called Quakers, used solely for the burial of the bodies of such people, unless the same shall be expressly mentioned in such order; and nothing in this act shall prevent the burial in any such burial ground in which for the time being interment is not required to be discontinued of the bodies of such people.

8. [Exempts Peter-street and Merrion-row (Dublin) burial grounds.]

Penalty on persons burying contrary to the provisions of Orders in Council.

9. If any person after the time mentioned in any order in Council under this act for the discontinuance of burials shall knowingly and wilfully bury any body, or in anywise act or assist in the burial of any body, in or under any church, chapel, churchyard, burial ground or place of burial, or elsewhere, as the case may be, within the limits in which burials have by such order been ordered to be discontinued, in violation of the provisions of any such order, every person so offending shall, upon summary conviction thereof, forfeit a sum not exceeding ten pounds.

Saving of certain rights to bury in vaults.

10. Provided always, that, notwithstanding any such order in Council, where, by virtue of any faculty legally granted, or by usage or otherwise, there is at the time of the passing of this act any usage or right of interment in or under any church or chapel affected by such order, or in any vault of any such church or chapel, or of any churchyard or burial ground affected by such order, and where any exclusive right of interment in any such burial ground has been purchased or acquired before the passing of this act, it shall be lawful for the Lord Lieutenant^a from time to time, on application being made to him, and on being satisfied that the exercise of such right shall not be injurious to health, to grant a licence for the exercise of such right, during such time and subject to such conditions and restrictions as the Lord Lieutenant^a may think fit; but such licence shall not prejudice or in anywise affect the authority of the ordinary or of any other person who if this act had not been passed might have prohibited or controlled interment under such right, nor dispense with any consent which would have been required under such right, nor otherwise give to such right any greater

force or effect than the same would have had if this act had not been passed.

11. Where by any such order in Council it is ordered that no new burial ground shall be opened in any city or town or within any limits in such order mentioned, without the previous approval of the Lord Lieutenant, *a* no new burial ground or cemetery (parochial or non-parochial) shall be provided and used in such city or town or within such limits without such previous approval.

New burial grounds not to be opened contrary to order in Council.

12. Where by usage or otherwise any grave, vault, or place of interment in any burial ground or cemetery has been the burying place of and used as such by any family, no corpse of any person not having been a member of such family shall be buried in such grave, vault, or place of interment without the consent in writing of some immediate relative of the member of such family last interred therein; and if any person shall knowingly act or assist in any burial contrary to the provisions of this clause, every such person shall be liable, on summary conviction before any two justices of the peace at petty sessions, to a penalty not exceeding ten pounds; and upon any complaint made under this clause it shall be lawful for the justices at petty sessions to make such order for the exhumation and re-interment of such corpse so buried as to such justices shall seem fit.

No corpse to be buried in private grave without consent.

13. No animal of any description shall be allowed to graze or to be within the limits of any burial ground having a sufficient fence; and it shall be lawful to any two justices of the peace at petty sessions to order the owners of any animal or animals so found within such burial ground to pay as a fine a sum not exceeding two shillings and not less than one shilling for each animal so found as aforesaid, and to levy and dispose of said fine in the same manner as fines for trespass of cattle are now levied and disposed of under the provisions of the law at present in force in *Ireland*.

No animal to be allowed to graze in burial places.

14. Although no burial ground has been closed by order in Council, *a* the clerk of the union in which any city, town, or place is situate, not being within the limits of a borough, and the town clerk of any borough, shall, upon the requisition in writing of ten or more persons assessed for the relief of the poor in such city, town, or place, or liable to the payment of borough rate in such borough respectively, or upon the requisition in writing of any two or more members of the burial board of such union or borough respectively, convene a special meeting of the burial board of such union or borough, for determining whether a burial ground shall be provided under this act for such city, town, or place, or for such borough respectively; and if a majority of such meeting shall resolve that a burial ground shall be provided under this act for such city, town, or place, or borough respectively, such new burial ground shall be provided in the same manner as if an old burial ground had been closed by order in Council.

Upon requisition of ratepayers or members of burial board, meeting of board to be convened to determine whether burial ground shall be provided.

15. Whenever any burial ground shall have been closed in any city, town, or place, or in any borough respectively, by order in Council, the burial board may, if it shall seem necessary or expedient, forthwith proceed to provide a suitable and convenient burial ground for such city, town, or place, or borough respectively, and to make arrangements for facilitating interments therein, under the provisions of this act.

When burial grounds are closed by Order in Council, board to provide suitable burial grounds, &c.

16. Any burial ground may be provided under this act, either within or without the limits of the city or town or borough for which the same is provided, and in case any burial ground to be so provided for any city, town, or borough shall be situate without the limits of such city, town, or borough, the same shall, for the purposes of this act, be considered as if the same was within such limits; but no ground not already used as or appropriated for a cemetery shall be appropriated as a burial ground, or as an addition to a burial ground, under this act,

Consent of owners of houses to new burial grounds, where necessary.

a Local Government Board, *vide* 35 & 36 Vict., c. 60.

Board may purchase land for cemeteries, or contract with cemetery companies.

Certain provisions of 8 and 9 Vict., c. 18, incorporated with this act.

Liabilities of old burial grounds transferred to new burial grounds.

Management to be vested in burial boards.

Boards may sell exclusive rights of burial, and rights to erect monuments &c.

nearer than one hundred yards to any dwelling-house, without the consent in writing of the owner, lessee, and occupier of such dwelling-house.

17. For the providing such burial ground, it shall be lawful for the burial board to contract for and purchase or take any lands and buildings thereon, for the purpose of forming a burial ground, or for making additions to any burial ground to be formed or purchased under this act, as such board may think fit, or to purchase from any company or persons entitled thereto any cemetery or cemeteries, or part or parts thereof, subject to the rights in vaults and graves and other subsisting rights which may have been previously granted therein : provided always, that it shall be lawful for such board, in lieu of providing any such burial ground, to contract with any such company or persons entitled as aforesaid for the interment in such cemetery or cemeteries, and either in any allotted part of such cemetery or cemeteries, or otherwise, and upon such terms as the burial board may think fit, of the bodies of persons who would have had rights of interment in the burial grounds of such parish or place.

18. The Lands Clauses Consolidation Act, 1845,^a except the provisions of that act "with respect to the provisions to be made for affording access to the special act by all parties interested," and "with respect to the purchase and taking of lands otherwise than by agreement," shall be incorporated with this act ; and for the purposes of this act the expression "the promoters of the undertaking," wherever used in the said act, shall mean any burial board under this act : provided always, that the provisions in the said act "with respect to lands acquired by the promoters of the undertaking under the provisions of this or the special act, or any act incorporated therewith, but which shall not be required for the purposes thereof," shall be held to apply only to such lands in which no burial shall have taken place, and such provisions shall not be restricted in operation to any fixed period after the purchase of such lands.

19. Where any burial ground shall be closed under the provisions of this act, and a new burial ground provided in place thereof, the whole burthen upon and liabilities attaching to the burial ground so closed shall be transferred to and become burthens upon the burial ground provided in place thereof, and the revenues of the new burial ground shall be liable for the same in like manner as the revenues of the burial ground so closed were liable.

20. The general management, regulation, and control of the burial grounds provided under this act shall, subject to the provisions of this act, and the regulations to be made thereunder, be vested in and exercised by the respective burial boards providing the same : provided always that any question which shall arise touching the fitness of any monumental inscription placed or proposed to be placed in any part or portion of such grounds shall be determined by the proper ministers of the religious denomination to which such part or portion shall have been allotted : provided also, that at the burials of the bodies of members of the United Church of *England* and *Ireland*, or of the Roman Catholic Church, or of any other religious denomination, burial service according to the respective rites of such church or denomination may be performed or celebrated by the proper ministers of such church or denomination.

21. Any burial board, under such restrictions and conditions as they think proper, may sell the exclusive right of burial, either in perpetuity or for a limited period, in such parts of any burial ground provided by such board as may be appropriated to that purpose, and also the right of constructing any chapel, vault, or place of burial, with the exclusive right of burial therein, in perpetuity or for a limited period, and also the right of erecting and placing any monument, gravestone, tablet, or monumental inscription in such burial ground, subject to the provisions

^a 8 and 9 Vict., c. 18.

hereinbefore contained : provided always, that such exclusive rights shall not extend in all to a space of one half of such burial ground.

22. Any burial board may make such arrangements as they may from time to time think fit for regulating and facilitating the conveyance of the bodies of the dead from the place of death to any burial ground which shall be provided under this act, subject to the provisions of this act and the regulations to be made thereunder ; and it shall be lawful for any of the aforesaid cemetery companies from whom the burial board shall have made any such purchase, or with whom the burial board shall have made any such contract as hereinbefore provided, to undertake any such arrangement, and to carry the same into effect, subject to the provisions and regulations aforesaid.

Boards may make arrangements for facilitating the conveyance of bodies to burial grounds.

23. It shall be lawful for any burial board, subject to the provisions of this act and the regulations to be made thereunder, to hire, take, or lease, or otherwise to provide fit and proper places in which bodies may be received and taken care of previously to interment, and to make arrangements for the reception and care of the bodies to be deposited therein ; and for providing such places such boards may exercise all the powers vested in them under this act for providing burial grounds.

Places may be provided for reception of bodies until interment.

24. It shall be lawful for the *a* Lord Lieutenant in Council from time to time to make such rules and regulations in relation to the burial grounds and places of reception of bodies previous to interment which may be provided under this act as may seem proper for the protection of the public health and the maintenance of public decency, and for the proper registry of interments, and to provide for the imposition and recovery of penalties not exceeding ten pounds for each offence for the breach or non-observance of such regulations ; and the burial boards, and all other persons having the care of such burial grounds and places for the reception of bodies, shall conform to and obey such regulations.

Lord Lieutenant in Council may make regulations as to burial grounds, &c.

25. No funeral procession, or carriage in such procession, and no foot passenger shall, while going to or returning from the place of interment on the occasion of any interment, be liable to any toll or pontage.

Exemption of burials from toll.

26. It shall be lawful for any burial board to enclose, lay out, and embellish any burial ground provided by such board, in such manner as may be fitting or proper : Provided always, that in all cases in which a burial board shall provide a new burial ground under this act it shall be lawful for such burial board, with the sanction of the *a* Lord Lieutenant, to divide such new burial ground or some part thereof into certain parts and proportions, to be allotted in such manner as to the *a* Lord Lieutenant shall seem fit, for the burial of the members of any particular religious denomination ; and each such allotment shall, as the case may require, be consecrated according to the rites and by the proper ministers of the respective religious denominations for which each such allotment is so set apart.

Board may lay out and embellish burial ground.

27. Every burial board under this act shall, subject to the approval of the *a* Lord Lieutenant, fix and receive such fees and payments in respect of interments in any burial ground provided by such board as they shall think fit, and from time to time revise and alter such fees and payments ; and a table showing such fees and payments shall be printed and published, and shall be affixed and at all times continued on some conspicuous part of such burial ground.

Board to fix payments for interments in burial grounds.

28. Minutes of all proceedings of the burial board under this act, with the names of the members who attend each meeting, shall be kept ; and the burial board shall provide and keep books in which shall be entered true and regular accounts of all sums of money received and paid for or on account of the purposes of this act, and of all liabilities incurred by them for such purposes, and of the several purposes for which such sums of money are paid and such liabilities incurred ; and

Minutes of proceedings of Board to be entered in a book.

Board to keep accounts which shall be open to inspection.

Board may appoint and remove officers, &c.

Register of burials to be kept in every ground provided under this Act.

Public Works Loan Commissioners may advance money for the purposes of this Act.

Expenses of Act to be defrayed by a separate rate.

all such books shall at all reasonable times be open to the examination of every member of the burial board and ratepayer, without fee, and they may take copies of or extracts from such books, or any part thereof, without paying for the same.

29. The burial board may appoint and may remove at pleasure a clerk and such other officers and servants as shall be necessary for the business of the board in respect of or for the purposes of their burial ground, and may appoint reasonable salaries, wages, and allowances for such clerk, officers, and servants; and, when necessary, may hire a sufficient office for transacting the business of such burial board; and the provisions and clauses of the Commissioners' Clauses Act, 1847, with respect to the "appointment and accountability of the officers of the commissioners," shall, so far as the same are not varied by or inconsistent with the provisions of this act, be incorporated therewith; and the commissioners in the said act shall signify the "burial board" under this act.

30. All burials within any burial ground provided under this act shall be registered in a register book to be provided by the burial board providing such ground, and kept for that purpose; and such register book shall be so kept by some officer appointed by the said board to do that duty; and in such register book shall be distinguished in what parts of the burial ground the several bodies (the burials of which are entered in such register book) are buried, and such register book, or copies or extracts thereof, or purporting to be copies or extracts thereof, shall be received in all courts as evidence of the burials entered therein.

31. The commissioners for carrying into execution an act of the fourteenth and fifteenth year of her present Majesty, chapter twenty-three, intituled *An Act to Authorize for a Further Period the Advance of Money out of the Consolidated Fund to a Limited Amount, for carrying on Public Works and Fisheries and Employment of the Poor*, and any act or acts amending the same, may from time to time, if they shall so think fit, make to the burial board of any borough or place for the purposes of this act any loan, under the provisions of the recited act or the several acts therein recited or referred to, upon security of the assessments for the relief of the poor of the union, or the borough fund, or rates in this act mentioned.

32. For the purpose of defraying the expenses incurred in the execution of this act, or paying any money borrowed for such purpose, or any interest thereon, the guardians of every union who shall be appointed the burial board of such union or any part thereof, under the provisions of this act, shall from time to time make and levy such rates as may be necessary on every occupier of rateable hereditaments in or arising within such union or any part thereof, not being within the boundaries or limits of any borough as defined by this act; and all rates so made under this act by the guardians of such union shall be apportioned, assessed, and levied on such union, or on such electoral division situate in such union, and wholly or partly on the parishes for which any new burial ground shall have been provided under this act, as the Poor Law Commissioners for Ireland shall by any order in that behalf direct, and shall be apportioned, assessed, and levied as if the sums so payable were sums to be apportioned, assessed, and levied for the purpose of carrying into execution the laws for the relief of the destitute poor in Ireland; and all moneys borrowed by the guardians of such unions for the purposes of this act, or any interest thereon, shall be secured upon the rates authorized to be made by the guardians of such union by this act; and any money required to be raised in any borough or town in which a board of municipal commissioners shall have been elected, as hereinbefore mentioned, for defraying such expense, or paying any money borrowed under this act by the council of such borough, or the municipal commissioners or town commissioners of such town, or any interest thereon, by means of a rate levied in such borough or town, shall be raised by a separate rate to be

levied within such borough or town; and the council of such borough and the municipal commissioners of such town shall have all such powers for making and levying such rate respectively, and all provisions shall be applicable in respect thereof, as in the case of any borough rate or improvement rate authorized to be made therein under the provisions of the respective acts of Parliament under which the council of such borough or the municipal commissioners of such town are constituted: provided always, that such rates shall be levied wholly or partly in the parishes within such borough or town for which any new burial ground shall have been provided under this act as the Lord Lieutenant in Council shall by any order in that behalf direct; and provided also, that when the amount of the rates to be assessed by the council of such borough or the municipal commissioners or town commissioners of such town are limited by law to a certain rateable amount, such limitation shall not apply or extend to expenses incurred for carrying this act into execution; and it shall be lawful for the council of such borough or the municipal commissioners or town commissioners of such town to charge the expenses under this act in addition to the other borough or town rates respectively; and all moneys borrowed by the said council or the said commissioners under this act, or any interest thereon, shall be charged upon the rates authorized to be levied by the said council or commissioners respectively by this act.

33. It shall be lawful for the guardians of any union or the council of any borough to appropriate for the purposes of this act any land belonging to the board of guardians of such union or to the body corporate of such borough respectively, or vested in any feoffees, trustees, or others for the general benefit of the union or borough respectively, or any specific charity: provided always, that when any land so appropriated shall be subject to any charitable use, such land shall be taken on such conditions only as the Court of Chancery, in the exercise of its jurisdiction over charitable trusts, shall appoint and direct.

Guardians or Council may appropriate lands for purposes of Act.

34. [Vests a cemetery in county of Waterford in board of guardians.]

35. The provisions of "The Cemeteries Clauses Act, 1847," with respect to the protection of the cemetery, shall be incorporated with this act, and be applicable to any burial ground provided under this act; and the words "the company" in "The Cemeteries Clauses Act, 1847," shall signify the "burial board" under this act: provided always that every penalty imposed under and by virtue of this act shall be enforced, recovered, and appropriated under the provisions of the "Petty Sessions (*Ireland*) Act, 1851," except when the act or offence in respect of which such penalty shall have been incurred shall have been committed within the jurisdiction of the justices of the police district of *Dublin* metropolis, in which case such penalty shall be enforced and recovered under the provisions of the acts relating to such police districts.

Certain provisions of 10 and 11 Vict., c. 65, incorporated with this Act.

36. Every burial board under this act may, with the consent of the Lord Lieutenant, ^a borrow any sum of money not exceeding such sum as the Lord Lieutenant may sanction and appoint, required for providing, laying out, and embellishing any burial ground under this act, or any such purposes, and may charge the future assessments or rates respectively under this act with the payment of such money, and interest thereon, not exceeding six per cent.; provided that there shall be paid in every year, in addition to the interest of the money borrowed and unpaid, not less than one-twentieth of the principal sum borrowed, until the whole is discharged.

Burial Boards may borrow money for laying out burial ground, &c., and charge same on rates to be levied under this Act.

37. Any burial board acting under this act may, if they think fit, borrow money in order to pay off and discharge any security or securities, and secure the repayment of the money so borrowed and the interest to be paid thereon, in like manner as other moneys authorized to be borrowed by such burial board under this act.

Money may be borrowed to pay off securities.

Assessment to local rates not to be increased after purchase for the purposes of this or any former Act.

Burial Board may let land not required for burials.

Burial Board to keep in order closed burial grounds, &c.

Not to apply to private mausoleums.

38. No land already or hereafter to be purchased or acquired under the provisions of this act, for the purpose of a burial ground (with or without any building erected or to be erected thereon), shall, while used for such purposes, be assessed to any county, parochial, or other local rates at a higher value or more improved rent than the value or rent at which the same was assessed at the time of such purchase or acquisition.

39. It shall be lawful for any burial board, with the sanction of the Lord Lieutenant,^a and subject to regulations approved of by him, to let any land purchased by and invested in them under this act, and which has not been consecrated, and in which no body has been at any time interred, and which is not for the time being required for the purposes of a burial ground, in such manner and on such terms as such board may see fit, but so, nevertheless, that power shall be reserved to such board to resume any such land which may be required for the purposes aforesaid upon giving six months notice.

40. In every case in which any order in council has been or shall hereafter be issued for the discontinuance of burials in any churchyard or burial ground, the burial board shall maintain such churchyard or burial ground in decent order, and also do the necessary repair of the walls and other fences thereof; and the costs and expenses shall be repaid out of the rates by this act authorised, unless there shall be some other fund legally chargeable with costs and expenses.

41. [Applies only to Limerick Cemetery.]

42. The provisions of this act shall not apply to any private and exclusive family mausoleum or burial place not being within the limits of any public burial ground.

BURIAL GROUNDS ACT, 1871.

34 and 35 VICT., CAP. 33.

An Act to explain and amend the Burial Acts.

[29th June, 1871.]

Approval of Secretary of State to appointment of burial board.

1. Where the approval of one of her Majesty's Principal Secretaries of State to the appointment of a burial board by a vestry or meeting in the nature of a vestry is required under the burial acts, such vestry or meeting in the nature of a vestry shall not, after the passing of this act, appoint such board until a resolution of such vestry or meeting, declaring the expediency of such appointment, has been passed, and notice thereof sent to one of her Majesty's Principal Secretaries of State,^b and the same has been approved of by the Secretary of State, and approval of such resolution shall be deemed to be approval of the appointment of the board.

The Secretary of State before giving such approval may require notice of such resolution, in such form and containing such particulars as he may direct, to be published in such manner as he may think sufficient for giving notice thereof to all persons interested.

Provided that where the approval of one of her Majesty's Principal Secretaries of State has been given before the passing of this act to the appointment of any burial board, that approval shall be valid whether it has been given before or after the date of such appointment.

Act to be construed with acts in schedule Short title.

2. This act shall be construed as one with the acts mentioned in the schedule to this act, and those acts and this act may be cited together as the Burial Acts, 1852 to 1871, ^c and each of them may be cited as the Burial Act of the year in which it was passed.

^a Local Government Board acts instead of Council.

^b In Ireland the Local Government Board.

^c Most of which are not applicable to Ireland.

PROVISIONS OF "THE COMMISSIONERS CLAUSES ACT,
1847," 10 Vic., c. 16, which are incorporated with "*The Burial
Grounds (Ireland) Act, 1856.*"

And with respect to the appointment and accountability of the officers of the Commissioners, be it enacted as follows:

Sec. 65. The Commissioners^a may from time to time appoint and employ a treasurer, clerk, collector, assessor, and all such other officers to assist in the execution of this and the special act^a as they shall think necessary and proper, and from time to time remove any of such officers, and appoint others in the room of such as shall be so removed, or as may die, resign, or discontinue their offices, and may, out of the moneys to be raised for the purposes of this and the special act, pay such salaries and allowances to the said officers respectively as the commissioners^b shall think reasonable.

Power to Commissioners to appoint Clerk and other officers, and remove them from time to time.

66. The same person shall not be appointed to the office both of clerk and treasurer; and if any person being the clerk, or the partner of such clerk, or in the service of such clerk or of his partner, accept the office of treasurer—or if any person being the treasurer, or the partner of such treasurer or in the service of such treasurer, or of his partner, accept the office of clerk—he shall forfeit the sum of one hundred pounds; and any person may sue for such penalty by action of debt or on the case in any of the superior courts, and shall on recovery thereof be entitled to full costs of suit.

Offices of Clerk and Treasurer not to be held by the same person.

67. Every officer employed by the commissioners who shall exact or accept on account of anything done by virtue of his office, or in relation to the matters to be done under this or the special act, any fee or reward whatsoever, other than the salary or allowances allowed by the commissioners, or who shall be in anywise concerned or interested in any bargain or contract made by the commissioners, shall be incapable of being afterwards employed by the commissioners, and shall forfeit the sum of fifty pounds; and any person may sue for such penalty by action of debt or on the case in any of the superior courts, and shall on recovery thereof be entitled to full costs of suit.

Officer taking fees other than those allowed to lose his office, and forfeit £50.

68. Before any person, whether treasurer, collector, or other officer entrusted by the commissioners with the custody or control of moneys by virtue of his office, shall enter upon such office, the commissioners shall take sufficient security from him for the faithful execution thereof.

Security to be taken from all officers entrusted with money.

69. Every collector appointed or employed by the commissioners by virtue of this or the special act to collect any rates shall, within seven days after he shall have received any moneys on account of any such rates, pay over the same to the treasurer of the commissioners to their account; and the receipt of such treasurer for the moneys so paid shall be a sufficient discharge to the collector; and every such collector shall, in such time and in such manner as the commissioners direct, deliver to them true and perfect accounts in writing under his hand of all moneys received by him and of all moneys paid by him to the said treasurer by virtue of this or the special act, and also a list of the names of all persons who have neglected or refused to pay any rate or money owing by them, with a statement of the moneys due from them respectively.

Collectors to pay over moneys within seven days to the Treasurer.

^a The words "Special Act" are defined by the 2nd section to mean "any Act with which this Act shall be incorporated."

^b See sec. 29 of the Burial Grounds Act, according to which the term "Commissioners" used in this Act is to signify "Burial Board" under that Act.

Officers to
account.

70. Every collector and other officer appointed or employed by the commissioners by virtue of this or the special act shall, from time to time when required by the commissioners, make out and deliver to them, or to any person appointed by them for that purpose, a true and perfect account in writing, under his hand, of all moneys received by him on behalf of the commissioners; and such account shall state how and to whom and for what purpose such moneys have been disposed of; and together with such account such officer shall deliver the vouchers and receipts for such payments; and every such officer shall pay to the commissioners, or to any person appointed by them to receive the same, all moneys which shall appear to be owing from him upon the balance of such accounts.

Summary
recovery against
parties failing
to account.

71. If any such collector or other officer fail to render such accounts as aforesaid, or to produce and deliver up all the vouchers and receipts relating to the same in his possession or power, or to pay the balance thereof when thereunto required, or if for five days after being thereunto required he fail to deliver up to the commissioners, or to any person appointed by them to receive the same, all papers and writings, property, effects, matters, and things, in his possession or power, relating to the execution of this or the special act, or any act incorporated therewith, or belonging to the commissioners then on complaint thereof being made to a justice, or to the sheriff, such justice or sheriff shall summon such officer to appear before two or more justices, or before such sheriff, according as the summons may have been issued by a justice or by the sheriff, at a time and place to be set forth in such summons, to answer such charge; and upon the appearance of such officer, or upon proof that such summons was personally served upon him, or left at his last known place of abode, such justices or sheriff may hear and determine the matter in a summary way, and may adjust and declare the balance owing by such officer; and if it appear, either upon confession of such officer, or upon evidence, or upon inspection of the account, that any moneys of the commissioners are in the hands of such officer, or owing by him to the commissioners, such justices or sheriff may order such officer to pay the same, and if he fail to pay the amount it shall be lawful for such justices or sheriff to grant a warrant to levy the same by distress, or by poinding and sale, or in default thereof to commit the offender to gaol, there to remain without bail for a period not exceeding three months, unless the same be sooner paid.

Officers refusing
to make out
account and
deliver up
documents, &c.,
may be
committed to
prison.

72. If any such officer summoned as aforesaid refuse to make out such account in writing, or to produce and deliver to the justices or sheriff the several vouchers and receipts relating thereto, or to deliver up any books, papers, or writings, property, effects, matters, or things in his possession or power belonging to the commissioners, such justices or sheriff may commit such offender to gaol, there to remain until he shall have delivered up all the vouchers and receipts in his possession or power relating to such accounts, and all the books, papers, writings, property, effects, matters, and things, in his possession or power, belonging to the commissioners.

Where officer
about to
abscond, a
warrant may be
issued in the
first instance.

73. Provided always, that if any commissioner, or other person acting on behalf of the commissioners, shall make oath that he has good reason to believe, upon grounds to be stated in his deposition, and that he does believe, that it is the intention of any such officer as aforesaid to abscond, the justice or the sheriff before whom the complaint is made may, instead of issuing his summons, issue his warrant for bringing such officer before such two justices as aforesaid if the warrant be issued by a justice, or before such sheriff if the warrant be issued by him; but no person executing such warrant shall

^a The Commissioners Clauses Act, 1847, is applicable to the whole of the United Kingdom.

keep such officer in custody longer than twenty-four hours without bringing him before some justice or the sheriff, according as he may be summoned before the one or the other; and the justice or sheriff before whom such officer may be brought may either discharge such officer, if he think there is no sufficient ground for his detention, or order such officer to be detained in custody so as to be brought before two justices at a time and place to be named in such order, unless such officer give bail to the satisfaction of such justice for his appearance before such justices to answer the complaint of the commissioners.

74. No such proceeding against or dealing with any such officer as aforesaid shall deprive the commissioners of any remedy which they might otherwise have against any surety of such officer.

Proceedings
against officers
not to discharge
sureties.

THE ADULTERATION OF ARTICLES OF FOOD OR DRINK ACT, 1860.

An Act for preventing the Adulteration *a* of Articles of Food or Drink.

[6th August, 1860.]

23 & 24 VICTORIA, CAP. 84.

Whereas the practice of adulterating articles of food and drink for sale, in fraud of her Majesty's subjects, and to the great hurt of their health, requires to be repressed by more effectual laws than those which are now in force for that purpose: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. Every person who shall sell any article of food or drink with which, to the knowledge of such person, any ingredient or material injurious to the health of persons eating or drinking such article has been mixed, and every person who shall sell as pure or unadulterated any article of food or drink which is adulterated or not pure, shall for every such offence, on a summary conviction of the same before two justices of the peace at Petty Sessions in *England*, and in *Scotland* before two justices of the peace in Justice of the Peace Court, or before the sheriff substitute of the county, or before justices at Petty Sessions or a divisional justice in *Ireland*, forfeit and pay a penalty not exceeding five pounds, *b* together with such costs attending such conviction as to the said justices shall seem reasonable; and if any person so convicted shall afterwards commit the like offence, it shall be lawful for such justices to cause such offender's name, place of abode, and offence to be published, at the expense of such offender, in such newspaper or in such other manner as to such justices shall seem desirable.

Penalty on
persons selling
articles of food
or drink knowing
the same to be
injurious to
health.

As to subsequent
offences.

a For definition of adulteration and method of procedure in relation to the anti-adulteration acts, see chapter on adulteration, page 300.

b Penalties increased by later Act, see page 457.

Power to appoint
Analysts.

2. In the City of *London* and the Liberties thereof the Commissioners of Sewers of the City of *London* and the Liberties thereof, and in all other parts of the metropolis the Vestries and District Boards acting in execution of the Act for the better Local Management ^a of the Metropolis, in *England* and *Ireland* the Court of Quarter Sessions of every County, and the Town Council of every Borough having a separate Court of Quarter Sessions, and in *Scotland* the Commissioners of Supply at their ordinary meetings for counties, and Town Councils within their several jurisdictions, may, from time to time, for their respective city, districts, counties, or boroughs, appoint and remove one or more persons possessing competent medical, chemical, and microscopical knowledge as analysts of all articles of food and drink purchased within the said city, metropolitan districts, counties, or borough, and may pay to such analysts such salary or allowances as they may think fit; but such appointments and removals shall at all times be subject in *Great Britain* to the approval of one of her Majesty's principal Secretaries of State, and in *Ireland* to that of the Lord Lieutenant.

Protection
against articles
of food and
drink being
tampered with
by purchaser.

3. On the hearing by the justices of any complaint under this act in any district, county, or borough wherein any analyst shall have been appointed, the purchaser shall prove to the satisfaction of such justices that the seller of the article of food or drink alleged to be adulterated, or his servants, had such notice of the intention of the purchaser to have such article analysed, and also such opportunity of accompanying the purchaser to an analyst appointed by this act, as the justices shall think reasonable, in order to secure such article from being tampered with by the purchaser. *b*

Power to pur-
chasers of articles
of food and
drink to have
them
analysed.

4. Any purchaser of any article of food or drink in any district, county, city, or borough where there is any analyst appointed under this act shall be entitled, on payment to the analyst of a sum not less than two shillings and sixpence, nor more than ten shillings and sixpence, to have any such article analysed by any analyst who may be appointed for such district, county, city, or borough, and to receive from such analyst a certificate of the result of his analysis, specifying whether in his opinion such article is adulterated, and also whether it is so adulterated as to be injurious to the health of persons eating or drinking the same; and such certificate duly signed by such analyst shall, in the absence of any evidence to the contrary, be sufficient evidence before the justices or in any court of justice of the matters therein certified, and the sum so directed to be paid for such certificate shall be deemed part of the costs.

Certificate of
analyst made
evidence.

Power to
Justices to have
articles of food
and drink
analysed.

5. The justices before whom any complaint may be made under this act may, in their discretion, cause any article of food or drink to be examined and analysed by such skilled person as they may appoint for that purpose, who may be required to give evidence of the same at the hearing of the case; and the expense thereof, and of such examination and analysis, if not paid by the complainant or party complained against, shall be deemed part of the expenses of executing this act; but nevertheless such expense may be ordered by such justices to be paid by the party so complaining or complained against, as they shall think proper.

Appeal to
Quarter Sessions.

6. Any person who has been convicted of any offence punishable by this act by any justices may appeal to the next General or Quarter Sessions of the Peace which shall be held for the city, county, town, or place wherein such judgment or conviction shall have been made; or in the case of the conviction having been before a sheriff substitute in *Scotland*, then the appeal shall be to the sheriff of the county; provided that such person enter into a recognizance within two days next

^a Now the Grand Juries, 35 & 36 Vict., c. 74, s. 5.

^b This section is, no doubt, virtually superseded by 35 & 36 Vic., c. 74, s. 8.

after such conviction, with two sufficient sureties, conditioned to try such appeal, and to be forthcoming to abide the judgment and determination of the court at such General or Quarter Sessions, or sheriff, and to pay such costs as shall be by such court awarded; and the justices before whom such conviction shall be had are hereby empowered and required to take such recognizance; and the court at such General or Quarter Sessions, or sheriff, are hereby authorized and required to hear and finally determine the matter of every such appeal, and may award such costs to the party appealing or appealed against as they shall think proper.

7. If any such conviction or judgment or order of forfeiture shall happen to be made within six days before any General or Quarter Sessions of the Peace shall be held for the city, county, town, or place wherein such conviction shall have been made, the person who shall think himself aggrieved by any such conviction may, on entering into a recognizance in manner and for the purposes before directed, be at liberty to appeal either to the then next or next following General or Quarter Sessions of the Peace which shall be held for any such city, county, town, or place wherein any such conviction shall have been made, on giving six days' notice to the complainant of his intention to appeal.

Where conviction within six days of Quarter Sessions, time allowed for appeal.

8. Any person who shall have been convicted by any justices or sheriff substitute of any offence punishable by this act, in respect of the selling of any article of food or drink which shall have been manufactured according to any process patented before the passing of this act, either by the patentee or owner of the patent, or by any person carrying on his business or otherwise claiming under him during the continuance of such patent, may, instead of appealing to the General or Quarter Sessions of the Peace or sheriff of the county, apply in writing within five days after such conviction to the justices or sheriff substitute, to state and sign a case for the opinion of one of the Superior Courts of Law thereon, in like manner as under the statute of the twentieth and twenty-first years of her Majesty, chapter forty-three, he might have applied to the justices to state and sign a case, and thereupon all such proceedings shall take place upon and in relation to such application, and all such provisions shall be applicable thereto as would have taken place upon and in relation thereto, and been applicable thereto, under the provisions of the said last-mentioned act; and in *Scotland*, for the purposes of such appeal, the justices or sheriff substitute may state and sign a case for the opinion of the Court of Session, in like manner as the justices in *England* and *Ireland* may for the opinion of the Superior Courts of Law under the said act, and the Court of Session shall have in relation thereto the like powers as the Superior Courts have under the said act, and all the other provisions of the said act shall be applicable to such appeals.

Persons convicted of selling adulterated patented article may have a case stated for opinion of superior court.

9. In *England* the provisions in the Nuisances Removal Act for *England*, 1855, as to procedure, and the provisions of the act of the eleventh and twelfth years of the reign of her present Majesty, intituled *An Act to facilitate the Performance of the Duties of Justices of the Peace and of Session within England and Wales with respect to summary convictions and orders*, and in *Scotland* the ordinary rules regulating the procedure of justices of the peace, so far as the same are respectively applicable, shall extend and apply to cases arising under this act in *England* or *Scotland*; and all moneys arising from penalties under this act in any county, city, district, or borough where there are analysts appointed under this act shall, when paid or recovered, be paid in *England* and *Ireland* to the vestry, district board, commissioners, county treasurer, or town council for such county, city, district, or borough respectively, to be applied for the general purposes of such vestry, district board, commissioners, county, city, or borough respectively, and to the collector of rogue money for each county in *Scotland*.

Procedure in cases under this Act.

Application of Moneys.

Proceedings
in Ireland as to
complaints, &c.,
to be subject to
provisions of
14 and 15 Vict.,
c. 93, and 21 and
22 Vict., c. 100.

10. All proceedings under this act in *Ireland* as to compelling the appearance of any such person or of any witness, and as to the hearing and determination of such complaints, and as to the making and executing of such orders, and as to the applications of fines, amerciaments, and forfeited recognizances imposed or levied under this act at Petty Sessions, shall be subject in all respects to the provisions of "The Petty Sessions (*Ireland*) Act, 1851," as the same is amended by "The Petty Sessions Clerk (*Ireland*) Act, 1858" (when the case shall be heard in any Petty Sessions district), and to the provisions of the acts relating to the Divisional Police Offices (when the case shall be heard in the Police District of *Dublin* Metropolis), so far as the said provisions shall be consistent with any special provisions of this act; and when any fine or penalty is imposed at any of the Divisional Police Offices of *Dublin* metropolis, or by the justices in any corporate town, under the provisions of this act, such fines and penalties shall be paid over to the same purposes and appropriated and applied in the same manner as is now by law authorized in respect of fines and penalties imposed at such Divisional Police Offices, or by the justices in any such corporate town respectively.

Appeal to
Quarter Sessions.

11. In *Ireland* any person who has been convicted of any offence punishable by this act may appeal to the next Court of Quarter Sessions to be held in the same division of the county where the order shall be made by any justice or justices in any Petty Sessions district, or to the recorder at his next Sessions where the order shall be made by the divisional justices in the Police District of *Dublin* metropolis, or to the recorder of any corporate or borough town when the order shall be made by any justice or justices in such corporate or borough town (unless when any such Sessions shall commence within seven days from the date of any such order, in which case, if the appellant sees fit, the appeal may be made to the next succeeding Sessions to be held for such division or town); and it shall be lawful for such Court of Quarter Sessions or recorder, as the case may be, to decide such appeal, if made in such form and manner, and with such notices, as are required by the Petty Sessions Acts respectively hereinbefore mentioned as to appeals against orders made by justices at Petty Sessions; and all the provisions of the said Petty Sessions Acts respectively as to making appeals and as to executing the orders made on appeal, or the original orders where the appeals shall not be duly prosecuted, shall also apply to any appeal or like order to be made under the provisions of this act.

As to expenses
of executing
Act.

12. The expense of executing this act shall be borne, in the city of *London* and the liberties thereof, out of the consolidated rates raised by the Commissioners of Sewers of the city of *London* and the liberties thereof, and in the rest of the metropolis out of any rates or funds applicable to the purposes of the act for the better local management of the metropolis, and in counties out of the county rate, and in boroughs out of the borough fund, or out of the rogue money in counties in *Scotland*.

Indictment or
other remedy
affected.

13. Nothing in this act contained shall be held to affect the power of proceeding by indictment, or to take away any other remedy against any offender under this act.

Interpretation of
terms.

14. In the construction of this act the words "articles of food or drink" shall (if not inconsistent with the context or subject matter) include not only all alimentary substances, whether solids or liquids, but also all eatables or drinkables whatsoever, not being medical drugs or articles usually taken or sold as medicines; but this act shall not be construed so as to affect the ordinary reduction of the strength of foreign, *British*, or colonial spirits by persons licensed and paying duties under the excise.

[See amendment to the above act, page 457, *et seq.* Both acts are to be construed as one.]

AN ACT TO AMEND THE LAW FOR THE PREVENTION
OF ADULTERATION OF FOOD AND DRINK AND
OF DRUGS.

35 & 36 VICT., CAP. 74.

[10th August, 1872].

1. Every person who shall wilfully admix, and every person who shall order any other person or persons to admix with any article of food or drink, any injurious or poisonous ingredient or material to adulterate the same for sale, and every person who shall wilfully admix, and every person who shall order any other person or persons to admix, any ingredient or material with any drug to adulterate the same for sale, shall for the first offence forfeit and pay a penalty not exceeding fifty pounds, together with the costs attending such conviction; and for the second offence shall be guilty of a misdemeanor, and be imprisoned for a period not exceeding six calendar months, with hard labour.

Penalties for mixing injurious ingredients with food, and adulteration of, by drugs.

2. Every person who shall sell any article of food or drink with which to the knowledge of such person any ingredient or material injurious to the health of persons eating or drinking such article has been mixed, and every person who shall sell as unadulterated any article of food or drink, or any drug which is adulterated, shall for every such offence, on a summary conviction of the same before two justices of the peace at petty sessions in England, or before two justices of the peace in the justices of the peace court, or before the sheriff substitute of the county, or before any magistrate acting under any general or local Police Act in Scotland, or before justices at petty sessions or a divisional justice in Ireland, forfeit and pay a penalty not exceeding twenty pounds, together with such costs attending such conviction as to the said justices, sheriff substitute, magistrate, or divisional justice shall seem reasonable; and if any person so convicted shall afterwards commit the like offence, such justices, sheriff substitute, magistrate, or divisional justice shall cause such offender's name, place of abode, and offence to be published, at the expense of such offender, in such newspaper or in such other manner as to the said justices shall seem desirable.

Penalty for adulterating food, drink, and drugs.

3. Any person who shall sell any article of food or drink or any drug, knowing the same to have been mixed with any other substance with intent fraudulently to increase its weight or bulk, and who shall not declare such admixture to any purchaser thereof before delivering the same and no other, shall be deemed to have sold an adulterated article of food or drink or drug, as the case may be, under this act.

Sale of mixed foods.

4. The Pharmacy Act, 1868, and the act twenty-third and twenty-fourth Victoria, chapter eighty-four, for preventing the adulteration of articles of food and drink, shall be deemed to be incorporated in this act: provided always that in the application of this act to Ireland the act passed in the session of Parliament held in the thirty-third and thirty-four years of the reign of her present Majesty, chapter twenty-six, intituled "An act to regulate the sale of poisons in Ireland," shall be deemed to be incorporated in this act instead of the Pharmacy Act, 1868.

Incorporation of poisons acts.

5. In the city of London and the liberties thereof the commissioners of sewers of the city of London and the liberties thereof, and in all other parts of the metropolis the vestries and district boards acting in execution of the act for the better local management of the metropolis; in England, the court of quarter sessions of every county, and the town council of every borough having a separate court of quarter sessions, or having under any general or local act of parliament or otherwise a separate

Appointment of analysts.

police establishment ; in Ireland, the grand jury of every county, county of a city, and county of a town, and town council of every borough, and in Scotland, the commissioners of supply at their ordinary meetings for counties, and the commissioners or boards of police, or, where there are no such commissioners or boards, the town councils for boroughs, within their several jurisdictions, may, and when required so to do by the Local Government Board in England, or by one of her Majesty's principal Secretaries of State in Scotland, or by the Lord Lieutenant or other chief governor or governors in Ireland, shall, for their respective city, districts, counties, or boroughs, appoint and remove one or more persons possessing competent medical, chemical, and microscopical knowledge as analysts of all articles of food, drink, and drugs purchased within the said city, metropolitan districts, counties, or boroughs, and shall pay to such analysts such salary or allowances as they may think fit ; but such appointments and removals shall at all times be subject in England to the approval of the Local Government Board, in Scotland of one of her Majesty's principal secretaries of state, and in Ireland of the Lord Lieutenant or other chief governor or governors.

Appointment of
inspectors.

6. The inspector of nuisances or the inspector of weights and measures or the inspector of markets, one or all of them, as the local authority appointing them shall think fit to determine, in every district, county, city, or borough, shall procure and submit samples of articles of food or drink and drugs suspected to be adulterated to be analysed by the analysts appointed under this act, and shall, upon receiving a certificate stating that the articles of food or drink or drugs are adulterated, cause a complaint of an offence against this act by the party selling or adulterating such articles of food or drink or drugs to be made before a justice of the peace, and thereupon such justice shall issue a summons requiring the seller or the adulterator to appear before two justices of the peace at petty sessions in England, or before two justices of the peace, in the justice of the peace court, or before the sheriff substitute of the county, or before any magistrate acting under any general or local police act in Scotland, or before justices of petty sessions or divisional justices in Ireland, to answer such complaint, and such summons shall be served by delivering the same, or a true copy thereof, upon the premises where such samples were obtained or sold, and the expense of such prosecutions, if not ordered to be paid by the party complained against, shall be deemed part of the expense of executing this act.

Analyst shall
report quarterly.

7. The analysts appointed under this act shall report quarterly to the local authorities appointing them the number of articles of food, drink, or drugs analysed by them under this act during the foregoing quarter, and shall specify the nature and kind of adulterations detected in such articles of food, drink, and drugs, and all such reports shall be read at the meetings of the local authorities appointing such analysts.

Delivery of
samples for
analysis.

8. On the hearing by the justices, sheriff substitute, magistrate, or divisional justice of any complaint under this act in any district, county, city, or borough wherein analysts shall have been appointed under this act, the purchaser, or inspector of nuisances, or the inspector of weights and measures, or the inspector of markets, as the case may be, shall prove to the satisfaction of such justices, sheriff substitute, magistrate, or divisional justice that the article of food or drink or drugs alleged to be adulterated was delivered to the analysts in the same condition as regards its purity or impurity as it was when received from the seller.

Purchasers of
food entitled to
have analyses
made.

9. Any purchaser of any article of food or drink or drugs in any district, county, city, or borough where there is any analyst appointed under this act shall be entitled, on payment to the inspector or inspectors appointed under this act of a sum not less than two shillings and sixpence nor more than ten shillings and sixpence, which shall be accounted for to the local authority appointing such inspector or inspectors, to have any such article analysed by any analyst who may be appointed for such district, county, city, or borough, and to receive from such analyst a

certificate of the result of his analysis, specifying whether, in his opinion, such article is adulterated, and also whether, if it be an article of food or drink, it is so adulterated as to be injurious to the health of persons eating or drinking the same, and such certificate, duly signed by such analyst, shall, in the absence of any evidence before the court to the contrary, be sufficient evidence of the matters therein certified, and the sum so directed to be paid for such certificate shall be deemed part of the costs.

10. All articles of food, drink, or drugs to be analysed by the analysts appointed under this act shall be received by the inspectors appointed by the local authorities, and from all such articles of food, drink, or drugs samples shall be taken and sealed in the presence of the analysts by the inspectors, to be retained by them and produced in case the justices, sheriff substitute, magistrate, or divisional justice shall order other analyses to be made.

Articles for analyses must be received by inspectors.

11. The expense of executing this act shall be borne, in the city of London and the liberties thereof, out of the consolidated rates raised by the commissioners of sewers of the city of London and the liberties thereof, and in the rest of the metropolis out of any rates or funds applicable to the purposes of the act for the better local management of the metropolis, and in counties out of the county rate, or out of the grand jury cess in Ireland, and in boroughs out of the borough fund; and in Scotland, out of the police money in counties and boroughs respectively.

Expenses in executing the Act.

12. Nothing in this act contained shall be held to affect the power of proceeding by indictment, or to take away any other remedy against any offender under this act.

Power of proceeding by indictment.

[See the Adulteration Act of 1860, page 553, *et seq.*]

AN ACT TO REGULATE THE SALE OF POISONS IN IRELAND.

33 & 34 VICT., CAP. 26.

[14th July, 1870.]

1. The several articles mentioned in the schedule A to this act annexed shall be deemed to be poisons within the meaning of this act; and the King and Queen's College of Physicians in Ireland may from time to time, by resolution, declare that any article other than those mentioned in the said schedule, and in such resolution named, ought to be deemed a poison within the meaning of this act; and thereupon the said college shall submit the said resolution for the approval of her Majesty's Privy Council in Ireland, and if such approval shall be given, then such resolution and approval shall be advertised in the *Dublin Gazette*; and on the expiration of one month from such advertisement the article named in such resolution shall be deemed to be a poison within the meaning of this act.

Articles named in Schedule A to be deemed poisonous within the meaning of this Act.

2. It shall be unlawful to sell any poison, either by wholesale or by retail, unless the box, bottle, vessel, wrapper, or cover in which such

Regulations to be observed in the sale of poisons.

poison is contained be distinctly labelled with the name of the article, and the word "poison," and with the name and address of the seller of the poison ; and it shall be unlawful to sell any of the poisons which are named in the first part of schedule A to this act annexed, or which may hereafter be added thereto under section one of this act, to any person unknown to the seller, unless such person is introduced by some person known to the seller ; and on every sale of any such article the seller shall, before delivery, make or cause to be made an entry in a book to be kept for that purpose, stating, in the form set forth in the schedule B to this act annexed, the date of the sale, the name and address of the purchaser, the name and quantity of the article sold, and the purpose for which it is stated by the purchaser to be required, to which entry the signature of the purchaser and of the person (if any) who introduced him shall be affixed ; and any person selling poison otherwise than is herein provided shall be liable to a penalty not exceeding five pounds for the first offence, and to a penalty not exceeding ten pounds for the second or any subsequent offence ; and for the purposes of this section the person on whose behalf any sale is made by any apprentice or servant shall be deemed to be the seller ; but the provisions of this section which are solely applicable to poisons in the first part of the schedule A to this act annexed, or which require that the label shall contain the name and address of the seller, shall not apply to articles to be exported from Ireland by wholesale dealers, nor to sales by wholesale to retail dealers in the ordinary course of wholesale dealing, nor shall any of the provisions of this section apply to any medicine supplied by a duly qualified apothecary, nor apply to any article when forming part of the ingredients of any medicine dispensed by a duly qualified apothecary, provided such medicine be labelled in the manner aforesaid with the name and address of the seller, and the ingredients thereof be entered with the name of the person to whom it is sold or delivered in a book to be kept by the seller for that purpose ; and nothing in this act contained shall repeal or affect any of the provisions of the act of the fourteenth and fifteenth years of the reign of her present Majesty, intituled "An Act to Regulate the Sale of Arsenic."

Adulteration of
Food or Drink
Act to extend to
medicines.

Recovery and
application of
penalties.

3. The provisions of the act of the twenty-third and twenty-fourth years of the reign of her present Majesty, intituled "An Act for Preventing the Adulteration of Articles of Food or Drink," shall extend to all articles usually taken or sold as medicines, and every adulteration of any such article shall be deemed an admixture injurious to health.

4. Every penalty recoverable under the provisions of this act shall be recoverable in a summary way, with respect to the police district of Dublin metropolis, subject and according to the provisions of any act regulating the powers and duties of justices of the peace for such district or of the police of such district ; and with respect to other parts of Ireland, before a justice or justices of the peace sitting in petty sessions, subject and according to the provisions of the Petty Sessions (Ireland) Act, 1851, and any act amending the same, and shall be applied according to the provisions of the Fines Act (Ireland), 1851, or by any act amending the same.

SCHEDULE A.

PART I.

Arsenic, and its preparations ; Prussic acid ; cyanides of potassium and all metallic cyanides ; strychnine, and all poisonous vegetable alkaloids and their salts ; aconite, and its preparations ; emetic tartar ; corrosive sublimate ; cantharides ; savin, and its oil ; ergot of rye, and its preparations.

PART II.

Oxalic acid ; chloroform ; belladonna, and its preparations ; essential

oil of almonds, unless deprived of its prussic acid ; opium, and all preparations of opium or of poppies ; preparations of corrosive sublimate ; preparations of morphine ; red oxide of mercury (commonly known as red precipitate of mercury) ; ammoniated mercury (commonly known as white precipitate of mercury) ; every compound containing any of the poisons mentioned in this schedule, when prepared or sold for the destruction of vermin ; the tincture and all vesicating liquid preparations of cantharides.

SCHEDULE B.

Date	Name of Purchaser.	Name and Quantity of Poison sold.	Purposes for which it is required.	Signature of Purchaser.	Signature of Person introducing Purchaser.

PETROLEUM ACTS.

(25 & 26 Vic., c. 66, & 35 & 36 Vic., c. 56.)

Provides that more than forty gallons of petroleum shall not be kept unless by license of local authorities, and under conditions specified by them—within fifty yards of a dwelling or goods' store, under a penalty not exceeding £20 a day. Local authorities:—All municipalities, and where there are none, the justices assembled at petty sessions. Persons refused licences, or granted them on too strict conditions, may appeal to the Lord Lieutenant. Any person selling petroleum which gives off inflammable vapours under 100° Fah., without attaching to the vessel containing it a label stating that "great care must be taken in bringing any light too near the contents of this vessel, as they give off an inflammable vapour at a temperature of less than 100° of Fahrenheit's thermometer," is liable to a fine of £5. The inspectors of weights and measures are empowered to inspect and test the petroleum on sale in their districts. An apparatus for the purpose must be procured from a chemical apparatus maker ; but if there be an analyst for the district he should test the article.

462 *Small Penalties—Steam Whistles Acts.*

AN ACT TO REGULATE THE USE OF STEAM WHISTLES IN CERTAIN MANUFACTORIES.

35 & 36 VICT., CAP. 61.

[6th August, 1872.]

1. This act shall not apply to Scotland.

2. No person shall use or employ in any manufactory, or any other place, any steam whistle^a or steam trumpet for the purpose of summoning or dismissing workmen or persons employed, without the sanction of the sanitary authority, and every person offending against this section shall be liable to a penalty not exceeding five pounds, and to a further penalty not exceeding forty shillings for every day during which such offence continues: provided always, that the Sanitary Authority, in case they have sanctioned the use of any such instrument as aforesaid, may at any time revoke such sanction on giving one month's notice to the person using the same: provided also, that it shall be lawful for the Local Government Board, on representation made to them by any person that he is prejudicially affected by such sanction, to revoke the same, and such revocation shall have the same force and effect as if it had been made by the Sanitary Authority.

3. "Sanitary Authority" means the authority at the time being empowered to execute the Nuisance Removal Acts, as defined and extended by "The Sanitary Act, 1866."

4. All offences and penalties under this act may be prosecuted and recovered in England in manner directed by the act of the session of the eleventh and twelfth years of the reign of her present Majesty, chapter forty-three, and any acts amending the same; and in Ireland, in the police district of Dublin metropolis, in manner directed by the acts regulating the powers and duties of justices of the peace for such district, or of the police of that district; and elsewhere in manner directed by the Petty Sessions (Ireland) Act, 1851, and any act amending the same.

SMALL PENALTIES ACT.

36 & 37 VIC., CAP. 82.

In summary convictions (for selling adulterated food or other offences), where the penalty does not exceed £5, the offender on non-payment, may be sent to prison for seven days if fine does not exceed 10s.; for fourteen days if above 10s., and not more than 20s.; one month if above £1, and not more than £2; and two months if the fine exceed £2, but is not more than £5.

CLOSING OF BURIAL GROUNDS.

Owing to a defect just discovered in the wording of Section 18 of the Public Health Act, 1874, the Local Government Board have in cases of application for closure of burial grounds to personally hear the arguments of counsel; they, however, have decided to take the evidence given before their inspector, and not to listen to it themselves.

^a In prosecutions under this act evidence must be given as to the actual whistle or trumpet emitting the noise.

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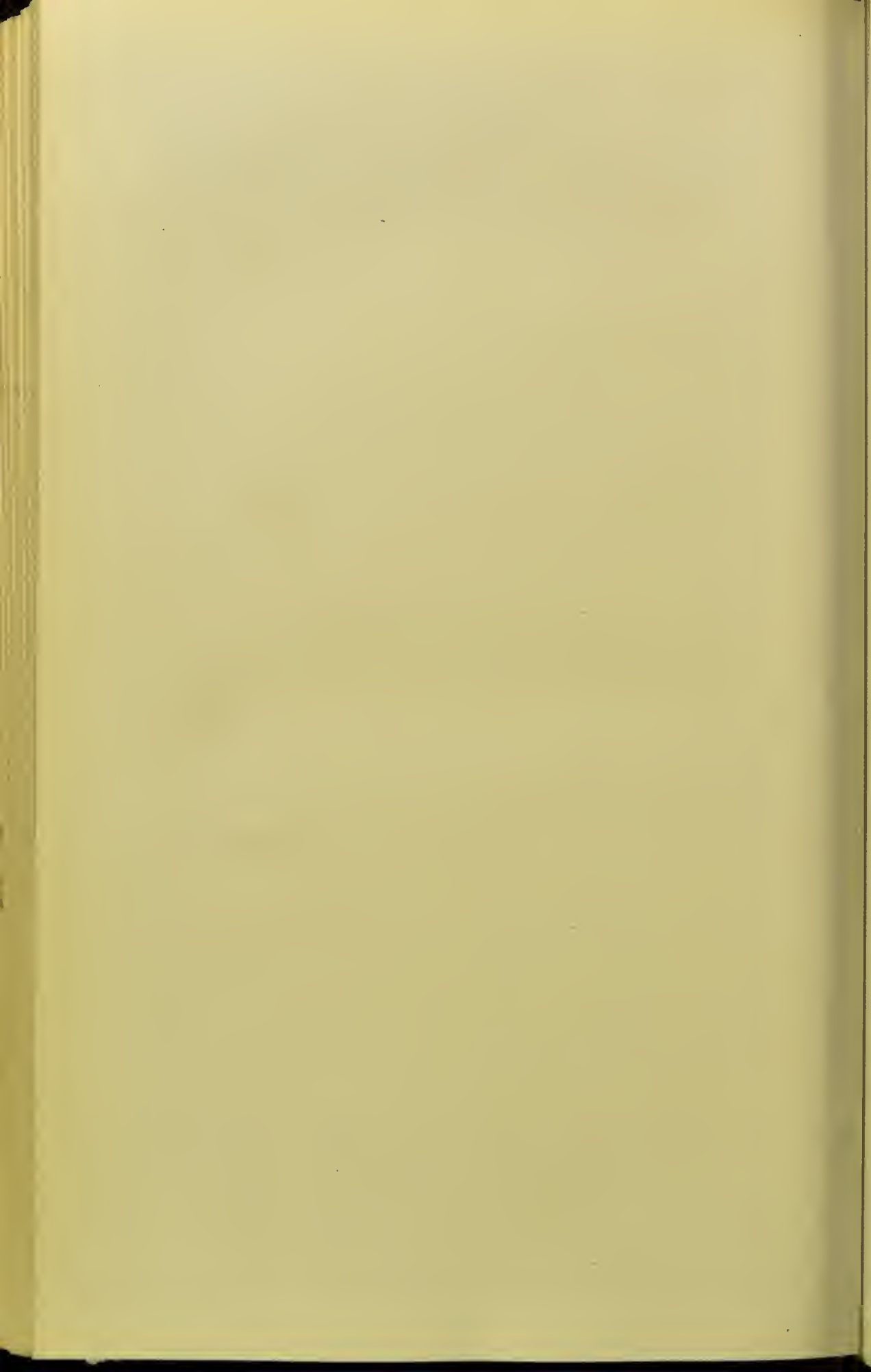
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